Part No. 92784SL, Rev. E

Service Manual

Greensmaster® 3100/3050

Preface

This publication provides the service technician with information for troubleshooting, testing, and repair of major systems and components on the Greensmaster 3100 and 3050.

REFER TO THE TRACTION UNIT, CUTTING UNIT AND ACCESSORY OPERATOR'S MANUALS FOR OPERATING, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS. Space is provided at the end of Chapter 2 in this publication to insert the Operator's Manuals and Parts Catalogs for your machine. Replacement Operator's Manuals are available by sending complete Model and Serial Number of traction unit and cutting unit to:

The Toro Company
8111 Lyndale Avenue South
Minneapolis, MN 55420

The Toro Company reserves the right to change product specifications or this publication without notice.

This safety symbol means DANGER, WARNING, or CAUTION, PERSONAL SAFETY INSTRUCTION. When you see this symbol, carefully read the instructions that follow. Failure to obey the instructions may result in personal injury.

NOTE: A NOTE will give general information about the correct operation, maintenance, service, testing or repair of the machine.

IMPORTANT: The IMPORTANT notice will give important instructions which must be followed to prevent damage to systems or components on the machine.

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TORO

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Safety

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Safety Instructions

The Greensmaster 3100 has been tested and certified for compliance with the B71.4-1984 specifications of the American National Standards Institute (ANSI) for riding mowers when 40 lbs. of ballast is added to rear wheel. Hazard control and accident prevention are dependent upon the awareness, concern, and proper training of the personnel involved in the operation, transport, maintenance and storage of the machine. Improper use or maintenance of the machine can result in personal injury or death. To reduce the potential for injury or death, comply with the following safety instructions.

CAUTION

Obey the following safety instructions. Read and understand these instructions before operating the Greensmaster 3100 or doing maintenance, troubleshooting, testing, adjustments or repairs. Failure to comply with the safety instructions may result in personal injury.

Before Operating

1. Read and understand the Operator's Manual before starting, operating, maintaining or repairing the machine. Replacement Operator's Manuals are available by sending complete Model and Serial Number of traction unit and cutting units to:

The Toro Company
8111 Lyndale Avenue South
Minneapolis, MN 55420

Use the Model and Serial Number when referring to your machine. If you have questions about this Service Information, please contact:

The Toro Company
Commercial Service Department
8111 Lyndale Avenue South
Minneapolis, MN 55420

2. Never allow children to operate the machine or adults to operate it without proper instruction.

3. Become familiar with the controls and know how to stop the machine and engine quickly.

4. Keep all shields, safety devices and decals in place. If a shield, safety device or decal is defective or damaged, repair or replace it before operating the machine.

5. Always wear substantial shoes. Do not operate machine wearing sandals, tennis shoes, sneakers or when barefoot. Do not wear loose fitting clothing that could get caught in moving parts and possibly cause personal injury.

6. Wearing safety glasses, safety shoes, long pants and a helmet is advisable and required by some local ordinances and insurance regulations.

7. Make sure the work area is clear of objects which might be picked up and thrown by the reels.

8. Do not carry passengers on the machine. Keep everyone, especially children and pets, away from the areas of operation.

9. Since gasoline is highly flammable, handle it carefully:

A. Use an approved fuel container.

B. Do not remove fuel tank cap while engine is hot or running.
C. Do not smoke while handling fuel.
D. Fill fuel tank outdoors and only to within an inch (25 mm) from the top of the tank, not the filler neck. Do not overfill.
E. Wipe up any spilled fuel.

While Operating

10. Do not run engine in a confined area without adequate ventilation. Exhaust is hazardous and could be deadly.

11. Sit on the seat when starting and operating the machine.

12. Check interlock switches daily for proper operation. If a switch fails, replace it before operating the machine. The interlock system is for your protection, so do not bypass it. Replace all interlock switches every two years.

13. To start the engine:

A. Sit on the seat, depress lift pedal and release it to disengage cutting units.
B. Verify that traction system is in neutral.
C. Verify that parking brake is set.
D. Proceed to start the engine.

14. Using the machine demands attention. To prevent loss of control:

A. Mow only in daylight or when there is good artificial light.
B. Watch for holes or other hidden hazards.
C. Be extremely careful when operating close to sand traps, ditches, creeks, steep hillsides or other hazards.
D. Reduce speed when making sharp turns. Avoid sudden stops and starts.
E. Look to the rear to assure no one is behind the machine before backing up.
F. Watch for traffic when near or crossing roads. Always yield the right-of-way.
G. Apply the service brakes when going down hill to keep forward speed slow and to maintain control of the machine.

15. Keep hands, feet and clothing away from moving parts and the reels. The grass baskets must be in place during operation of the reels or thatchers for maximum safety. Shut the engine off before emptying the baskets.

16. Raise cutting units when driving from one work area to another.

17. Do not touch engine, muffler or exhaust pipe while engine is running or soon after it is stopped. These areas could be hot enough to cause burns.

18. Stay clear of rotating screen at side of engine to prevent direct contact with body or clothing.

19. If cutting unit strikes a solid object or vibrates abnormally, stop immediately, turn engine off, set parking brake and wait for all motion to stop. Inspect for damage. If reel or bedknife is damaged, repair or replace it before operating.

20. Before getting off the seat:

A. Move shift selector to N (neutral).
B. Depress the lift pedal to raise the cutting units, wait for the reels to stop spinning and release lift pedal.
C. Set the parking brake.
E. Stop engine and remove key from switch.

21. Traverse slopes carefully. Do not start or stop suddenly when traveling uphill or downhill.

22. Operator must be skilled and trained in how to drive on hillsides. Failure to use caution on slopes or hills may cause loss of control and vehicle to tip or roll, possibly resulting in personal injury or death.

23. If engine stalls or loses headway and cannot make it to the top of a slope, do not turn machine around. Always back slowly straight down the slope.

24. DO NOT TAKE AN INJURY RISK! When a person or pet appears unexpectedly in or near the mowing area, STOP MOWING. Careless operation, combined with terrain angles, ricochets, or improperly positioned guards can lead to thrown object injuries. Do not resume mowing until area is cleared.

25. Whenever machine is left unattended, make sure cutting units are fully raised and reels are not spinning, key is removed from ignition switch and parking brake is set.

While Doing Maintenance, Troubleshooting, Testing, Adjustments or Repairs

26. Before servicing or making adjustments to the machine, stop the engine, remove key from ignition switch and pull wires off spark plugs to prevent accidental starting of the engine.

27. Make sure the entire machine is properly maintained and in good operating condition. Frequently tighten all nuts bolts. and screws.

28. Make sure all hydraulic line connectors are tight and all hydraulic hoses and lines are in good condition before applying pressure to the system.

29. Keep body and hands away from pin hole leaks or nozzles that eject high pressure hydraulic fluid. Use cardboard or paper to find hydraulic leaks. Hydraulic fluid escaping under pressure can penetrate the skin and cause injury. Fluid accidentally injected into the skin must be surgically removed within a few hours by a doctor or gangrene may occur.

30. Before disconnecting or performing any work on the hydraulic system, all pressure in system must be relieved by stopping engine and lowering cutting units and attachments to the ground.

31. To reduce potential fire hazard, keep engine area free of excessive grease, grass, leaves and dirt. Do not use flammable solvents for cleaning parts. Do not use diesel fuel, kerosene or gasoline.

32. If the engine must be running to perform an inspection or procedure, use extreme caution. Always use two people, with the operator at the controls able to see the person doing the inspection or procedure. Keep hands, feet, clothing, and body away from cutting units and other moving parts.

33. Do not overspeed the engine by changing governor settings. Maximum governed engine speed should be 2850 rpm.

34. Shut engine off before checking or adding oil to the engine crankcase.

35. Be sure you understand a service procedure before working on the machine. Unauthorized modifications to the machine may impair the function, safety and life of the machine. If major repairs are ever needed, or assistance is desired, contact your TORO Distributor.

36. Wear safety glasses, goggles or a face shield to prevent possible eye injury when using compressed air for cleaning or drying components.

37. When changing attachments or performing other service, use the correct blocks and hoists. Always use jackstands to safely support the machine when it is raised by a jack or hoist.

38. Do not use your hand to prevent cutting unit reel from turning while servicing; this can result in personal injury. Use a 1/2 in. thick x 3 in. wide x 8 in. long piece of hardwood inserted into front of cutting unit between reel blades.

39. For optimum performance and safety, use genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers could be dangerous and my void the product warranty of The Toro Company.

Chapter 2

Product Records and Manuals

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Product Records

Insert Operator's Manual and Parts Catalog for your Greensmaster 3100 or 3050 at the end of this chapter. Refer to Operator's Manual for recommended maintenance intervals. Additionally, insert Installation Instructions, Operator's Manuals and Parts Catalogs for any accessories that have been installed on your Greensmaster 3100 or 3050 at the end of this section.

Equivalents and Conversions

Decimal and Millimeter Equivalents

Fractions	Decimals	mm	Fractions	Decimals	mm
1/64	0.015625	— 0.397	33/64	0.515625	— 13.097
1/32	0.03125	— 0.794	17/32	0.53125	— 13.494
3/64	0.046875	— 1.191	35/64	0.546875	— 13.891
1/16	0.0625	— 1.588	9/16	0.5625	— 14.288
5/64	0.078125	— 1.984	37/64	0.578125	— 14.684
3/32	0.9375	— 2.381	19/32	0.59375	— 15.081
7/64	0.109275	— 2.778	39/64	0.609375	— 15.478
1/8	0.1250	— 3.175	**5/8**	0.6250	— 15.875
9/64	0.140625	— 3.572	41/64	0.640625	— 16.272
5/32	0.15625	— 3.969	21/32	0.65625	— 16.669
11/64	0.171875	— 4.366	43/64	0.671875	— 17.066
3/16	0.1875	— 4.762	11/16	0.6875	— 17.462
13/64	0.203125	— 5.159	45/64	0.703125	— 17.859
7/32	0.21875	— 5.556	23/32	0.71875	— 18.256
15/64	0.234375	— 5.953	47/64	0.734375	— 18.653
1/4	0.2500	— 6.350	**3/4**	0.7500	— 19.050
17/64	0.265625	— 6.747	49/64	0.765625	— 19.447
9/32	0.28125	— 7.144	25/32	0.78125	— 19.844
19/64	0.296875	— 7.541	51/64	0.796875	— 20.241
5/16	0.3125	— 7.541	13/16	0.8125	— 20.638
21/64	0.328125	— 8.334	53/64	0.828125	— 21.034
11/32	0.34375	— 8.731	27/32	0.84375	— 21.431
23/64	0.359375	— 9.128	55/64	0.859375	— 21.828
3/8	0.3750	— 9.525	**7/8**	0.8750	— 22.225
25/64	0.390625	— 9.922	57/64	0.890625	— 22.622
13/32	0.40625	— 10.319	29/32	0.90625	— 23.019
27/64	0.421875	— 10.716	59/64	0.921875	— 23.416
7/16	0.4375	— 11.112	15/16	0.9375	— 23.812
29/64	0.453125	— 11.509	61/64	0.953125	— 24.209
15/32	0.46875	— 11.906	31/32	0.96875	— 24.606
31/64	0.484375	— 12.303	63/64	0.984375	— 25.003
1/2	0.5000	— 12.700	**1**	1.000	— 25.400
1 mm = 0.03937 in.			**0.001 in. = 0.0254 mm**		

U.S to Metric Conversions

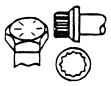
	To Convert	Into	Multiply By
Linear Measurement	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
Area	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
Volume	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
Weight	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
Pressure	Pounds/Sq. In.	Kilopascal	6.895
Work	Foot-pounds	Newton-Meters	1.356
	Foot-pounds	Kilogram-Meters	0.1383
	Inch-pounds	Kilogram-Centimeters	1.152144
Liquid Volume	Quarts	Liters	0.9463
	Gallons	Liters	3.785
Liquid Flow	Gallons/Minute	Liters/Minute	3.785
Temperature	Fahrenheit	Celsius	1. Subract 32° 2. Multiply by 5/9

Torque Specifications

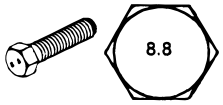
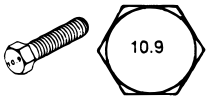
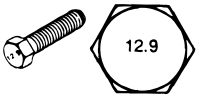
Use these torque values when specific torque values are not given. DO NOT use these values in place of specified values.

The torque values listed below are for lubricated threads. Plated threads are considered to be lubricated.

Capscrew Markings and Torque Values - U.S. Customary

SAE Grade Number	5				8			
Capscrew Head Markings								
Capscrew Body Size	Capscrew Torque - Grade 5				Capscrew Torque - Grade 8			
	Cast Iron		Aluminum		Cast Iron		Aluminum	
	ft-lb	Nm	ft-lb	Nm	ft-lb	Nm	ft-lb	Nm
1/4-20	7	9	6	8	11	15	9	12
-28	9	12	7	9	13	18	10	14
5/16-18	15	20	12	16	22	30	18	24
-24	17	23	14	19	24	33	19	25
3/8-16	30	40	20	25	40	55	30	40
-24	30	40	25	35	45	60	35	45
7/16-14	45	60	35	45	65	90	50	65
-20	50	65	40	55	70	95	55	75
1/2-13	70	95	55	75	95	130	75	100
-20	75	100	60	80	110	150	90	120
9/16-12	100	135	80	110	140	190	110	150
-18	110	150	85	115	155	210	125	170
5/8-11	135	180	110	150	190	255	150	205
-18	155	210	120	160	215	290	170	230
3/4-10	240	325	190	255	340	460	270	365
-16	270	365	210	285	380	515	300	410
7/8-9	360	490	280	380	550	745	440	600
-14	390	530	310	420	610	825	490	660
1-8	530	720	420	570	820	1100	660	890
-14	590	800	480	650	890	1200	710	960

Capscrew Markings and Torque Values – Metric

Commercial Steel Class	8.8				10.9				12.9			
Capscrew Head Markings												
Thread Diameter mm	Capscrew Torque - Class 8.8				Capscrew Torque - Class 10.9				Capscrew Torque - Class 12.9			
	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
	ft-lb	Nm	ft-lb	Nm	ft-lb	Nm	ft-lb	Nm	ft-lb	Nm	ft-lb	Nm
6	5	9	4	7	9	14	7	11	9	14	7	11
7	9	14	7	11	14	18	11	14	18	23	14	18
8	18	25	14	18	23	32	18	25	27	36	21	28
10	30	40	25	30	45	60	35	45	50	70	40	55
12	55	70	40	55	75	105	60	80	95	125	75	100
14	85	115	65	90	120	160	95	125	145	195	110	150
16	130	180	100	140	175	240	135	190	210	290	165	220
18	170	230	135	180	240	320	185	250	290	400	230	310

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Chapter 3

Engine

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Installing the Engine 5
BRIGGS & STRATTON VANGUARD V-TWIN OHV SERVICE & REPAIR INSTRUCTIONS

Specifications

Item	Specification
Make/Designation	Briggs & Stratton Vanguard® V-Twin OHV, air cooled, gas engine with cast iron cylinder sleeves
Crankcase Oil Capacity	See Operator's Manual
Oil	See Operator's Manual
Fuel	Unleaded Regular Gasoline
High Idle Speed (no load)	2800 $^{+50}/_{-100}$ RPM
Low Idle Speed (no load)	1400 ± 50 RPM

Adjustments

Throttle Control Adjustment (Fig. 1)

Before adjusting carburetor, make sure throttle control is operating properly.

1. Loosen cable clamp screw securing cable to engine.

2. Move remote throttle control lever forward to FAST position.

3. Pull firmly on throttle cable until back of swivel contacts stop.

4. Tighten cable clamp screw.

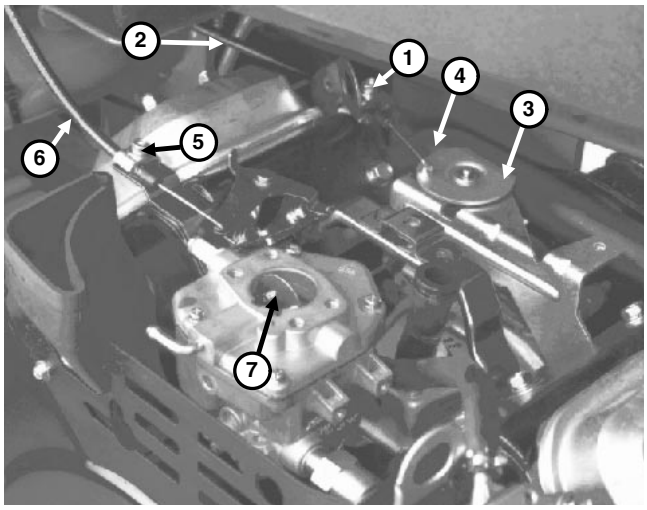

Figure 1

1. Throttle casing clamp screw
2. Throttle cable
3. Swivel
4. Stop
5. Choke casing clamp screw
6. Choke cable
7. Choke butterfly

Choke Control Adjustment (Fig. 1)

1. Loosen cable clamp screw securing cable to engine.

2. Move remote choke control lever forward to CLOSED position.

3. Pull firmly on choke cable until choke butterfly is completely closed, then tighten cable clamp screw.

Governor Adjustment (Before starting engine)

IMPORTANT: If carburetor has been removed or governor linkage disassembled, the governor lever, throttle restrictor and secondary governor spring must be adjusted before the engine is started.

Governor Lever Adjustment (Fig. 2)

All linkage must be installed to make adjustment. Loosen governor lever bolt and nut. Push on governor lever until throttle is wide open. DO NOT bend governor link. Hold lever in this position and rotate governor shaft counterclockwise as far as it will go. Hold lever and shaft in position and torque governor lever bolt and nut to 70 in-lb.

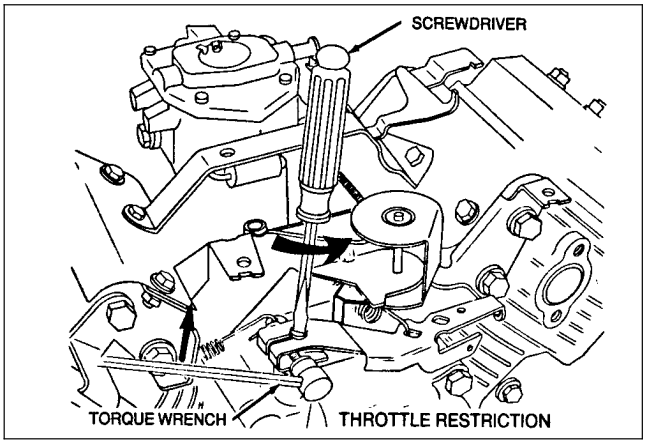

Figure 2

Throttle Restrictor Adjustment (Fig. 3)

Move throttle control lever to SLOW position. Hold governor lever so that throttle lever touches idle speed adjustment screw. Use tang bender (Briggs & Stratton Tool #19352) and bend throttle restrictor tang so throttle opening is limited to 1/4 in. travel when governor lever is released.

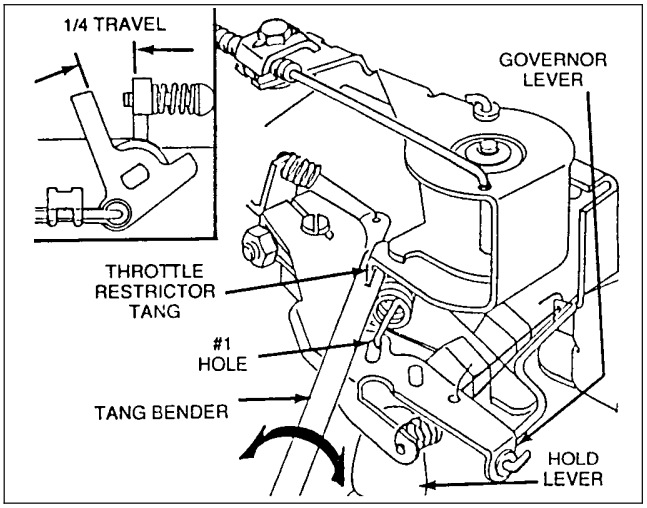

Figure 3

Secondary Spring Adjustments (Fig. 4)

With throttle control lever in SLOW position, install adjustment gauge (Brigss & Stratton Tool #19385) over end of governor lever as shown. Holding gauge in position, bend tab so that all slack is removed from secondary governor spring between its two anchor points. DO NOT STRETCH SPRING. Remove adjustment gauge.

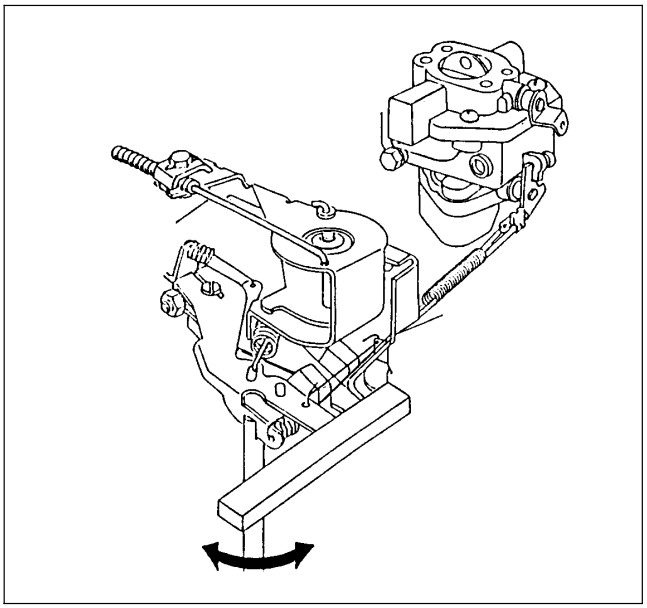

Figure 4

Carburetor and Speed Control Adjustment (Fig. 5, 6)

IMPORTANT: Before carburetor and speed control are adjusted, the throttle and choke controls must be adjusted properly.

WARNIN G

Engine must be running during adjustment of carburetor and speed control. To guard against possible personal injury, shift into neutral and engage parking brake. Keep hands, feet, face and other parts of the body away from the cutter blades and any rotating engine parts.

1. Start engine and let it run at half throttle for approximately five (5) minutes to warm up.

2. Move throttle control to SLOW position. Hold governor lever so throttle lever is in the idle position (against idle stop screw) and turn idle stop screw in or out to get 1400 ± 50 RPM. Check speed with a tachometer.

3. Adjust idle mixture screw:

   A. Turn idle mixture screw slowly clockwise (lean mixture) until engine speed just starts to decrease. Note position of screw.

   B. Now turn idle mixture screw slowly counterclockwise (rich mixture) until engine speed just starts to decrease. Note position of screw.

   C. Set the idle mixture screw half way between the rich and lean settings.

4. After idle mixture has been adjusted, hold governor lever so throttle lever is in idle position (against idle stop screw) and adjust idle stop screw to bring engine speed to 1200 ± RPM.

5. With governor control lever in governed idle position (no tension on high speed spring) bend governed idle spring anchor tang to get a governed idle speed of 1400 ± RPM (Fig. 5).

6. Move throttle control to FAST position. Bend high speed spring anchor tang to bring engine speed to 2800 +50/–100 RPM (Fig. 6).

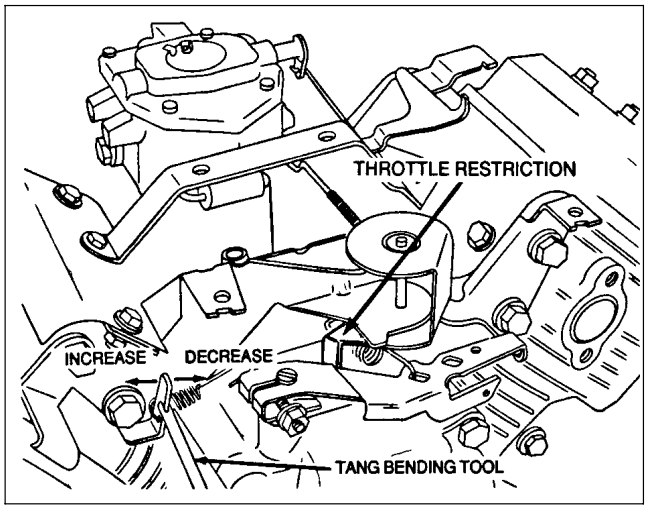

Figure 5

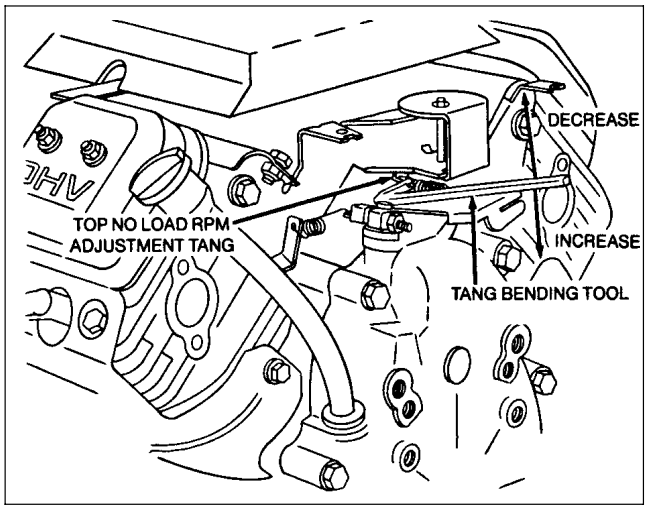

Figure 6

Engine Removal and Installation

Removing the Engine

1. Disconnect the negative (–) and positive (+) battery cables from the battery.

2. Close the fuel shut-off valve and disconnect the fuel line.

WARNIN G

Gasoline is highly flammable. Use caution while handling it. Do not smoke cigarettes, cigars or pipes. Dispose of the gasoline in a safe place immediately after draining.

3. Remove the starter cable, throttle and choke cable and ground wire from engine.

4. Disconnect the wiring harness connector.

5. Loosen the two (2) set screws securing the pump hub onto the engine shaft. Remove the two (2) capscrews securing the pump to the pump mount. DO NOT disconnect the hydraulic hoses from the pump.

6. Support the engine and remove the engine mount bolts, nuts and washers to remove the engine.

Installing the Engine

1. Support the engine, align it with the engine mounts, and instal the pump hub over the engine shaft and key. Be sure that the key is properly positioned and aligned with the keyway.

2. Install the engine mount bolts, washers and nuts.

3. Mount the pump to the pump housing and tighten the set screws to secure the hub to the shaft.

4. Re-connect the fuel line, wire connectors and the cables to the engine and battery.

5. Make sure the crankcase is filled the correct oil. Open the fuel shut-off valve. Fill the fuel tank. Start the engine and check for proper operation.

TORO®

Chapter 4

Hydraulic System

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Specifications

Item	Description
Hydraulic Pump Steering relief pressure (Greensmaster 3100)	External gear type 5 section (Greensmaster 3100) 4 section (Greensmaster 3050) 850 psi
Wheel Motor (2)	Orbit rotor type
Reel Motor (3)	External gear type
Control Valve Main and No. 1 section port relief pressure No. 2 and 3 section port relief pressure No. 4 (traction) section port relief pressure	5 section spool type 2000 psi 2000 psi 1850 psi
Power Steering Control	Gerotor type steering control unit
Hydraulic Oil	See Operator's Manual
Reservoir Capacity	See Operator's Manual
Oil filter	Screw-on cartridge type, 10 micron

General Information

Hydraulic Hoses

Hydraulic hoses are subject to extreme conditions such as, pressure differentials during operation and exposure to weather, sun, chemicals, very warm storage conditions or mishandling during operation or maintenance. These conditions can cause damage or premature deterioration. Some hoses, such as reel motor hoses, are more susceptible to these conditions than others. Inspect the hoses frequently for signs of deterioration or damage. To prevent possible problems it is recommended that hoses are replaced periodically, regardless of condition.

When replacing a hydraulic hose, be sure that the hose is straight (not twisted) before tightening the fittings. This can be done by observing the imprint on the hose. Use two wrenches; one to hold the hose straight and one to tighten the hose swivel nut onto the fitting.

WARNING

Before disconnecting or performing any work on the hydraulic system, all pressure in the system must be relieved by stopping the engine and lowering the cutting units to the ground.

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin and do serious damage. If fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result.

Hydraulic Fitting Installation

O-Ring Face Seal (Fig. 1, 2)

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign material.

2. Make sure the O-ring is installed and properly seated in the groove. It is recommended that the O-ring be replaced any time the connection is opened.

3. Lubricate the O-ring with a light coating of oil.

4. Put the tube and nut squarely into position on the face seal end of the fitting and tighten the nut until finger tight.

5. Mark the nut and fitting body. Hold the body with a wrench. Use another wrench to tighten the nut to the correct flats from finger tight (F.F.F.T.). The markings on the nut and fitting body will verify that the connection has been tightened.

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	.75 ± .25
6 (3/8 in.)	.75 ± .25
8 (1/2 in.)	.75 ± .25
10 (5/8 in.)	1.00 ± .25
12 (3/4 in.)	.75 ± .25
16 (1 in.)	.75 ± .25

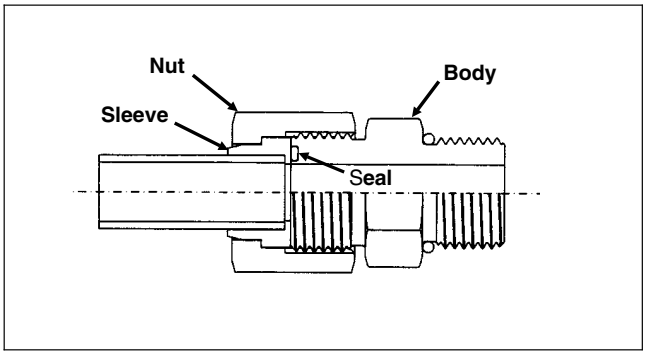


Figure 1

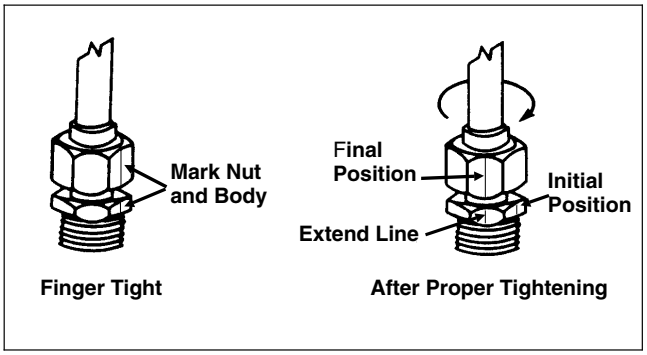


Figure 2

SAE Straight Thread O-Ring Port (Non-adjustable) (Fig. 3)

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign material.

2. Always replace the O-ring seal when this type of fitting shows signs of leakage.

3. Lubricate the O-ring with a light coating of oil.

4. Install the fitting into the port and tighten it down full length until finger tight.

5. Tighten the fitting to the correct flats from finger tight (F.F.F.T.).

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	1.00 ± .25
6 (3/8 in.)	1.50 ± .25
8 (1/2 in.)	1.50 ± .25
10 (5/8 in.)	1.50 ± .25
12 (3/4 in.)	1.50 ± .25
16 (1 in.)	1.50 ± .25

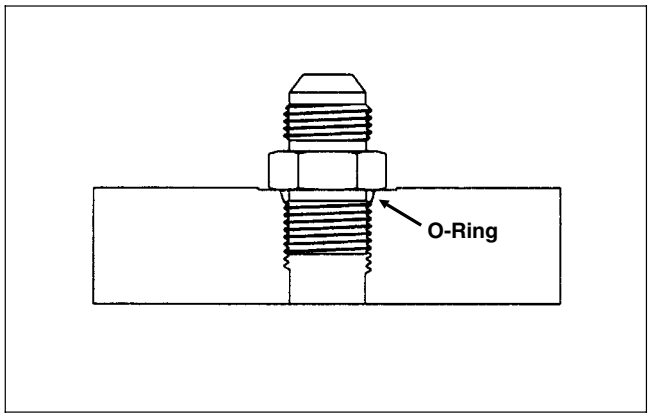


Figure 3

SAE Straight Thread O-Ring Port (Adjustable) (Fig. 4, 5)

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign material.

2. Always replace the O-ring seal when this type of fitting shows signs of leakage.

3. Lubricate the O-ring with a light coating of oil.

4. Turn back the jam nut as far as possible. Make sure the back up washer is not loose and is pushed up as far as possible (Step 1).

5. Install the fitting into the port and tighten finger tight until the washer contacts the face of the port (Step 2).

6. To put the fitting in the desired position, unscrew it by the required amount, but no more than one full turn (Step 3).

7. Hold the fitting in the desired position with a wrench and turn the jam nut with another wrench to the correct flats from finger tight (F.F.F.T.) (Step 4)

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	1.00 ± .25
6 (3/8 in.)	1.50 ± .25
8 (1/2 in.)	1.50 ± .25
10 (5/8 in.)	1.50 ± .25
12 (3/4 in.)	1.50 ± .25
16 (1 in.)	1.50 ± .25

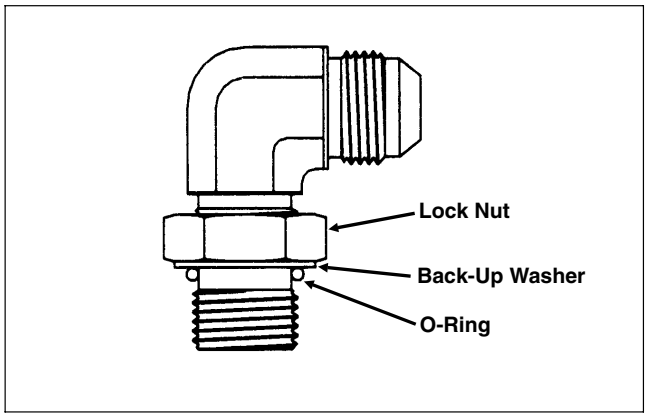


Figure 4

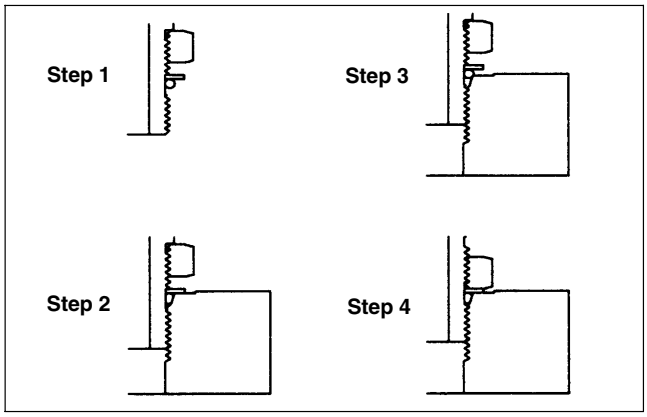
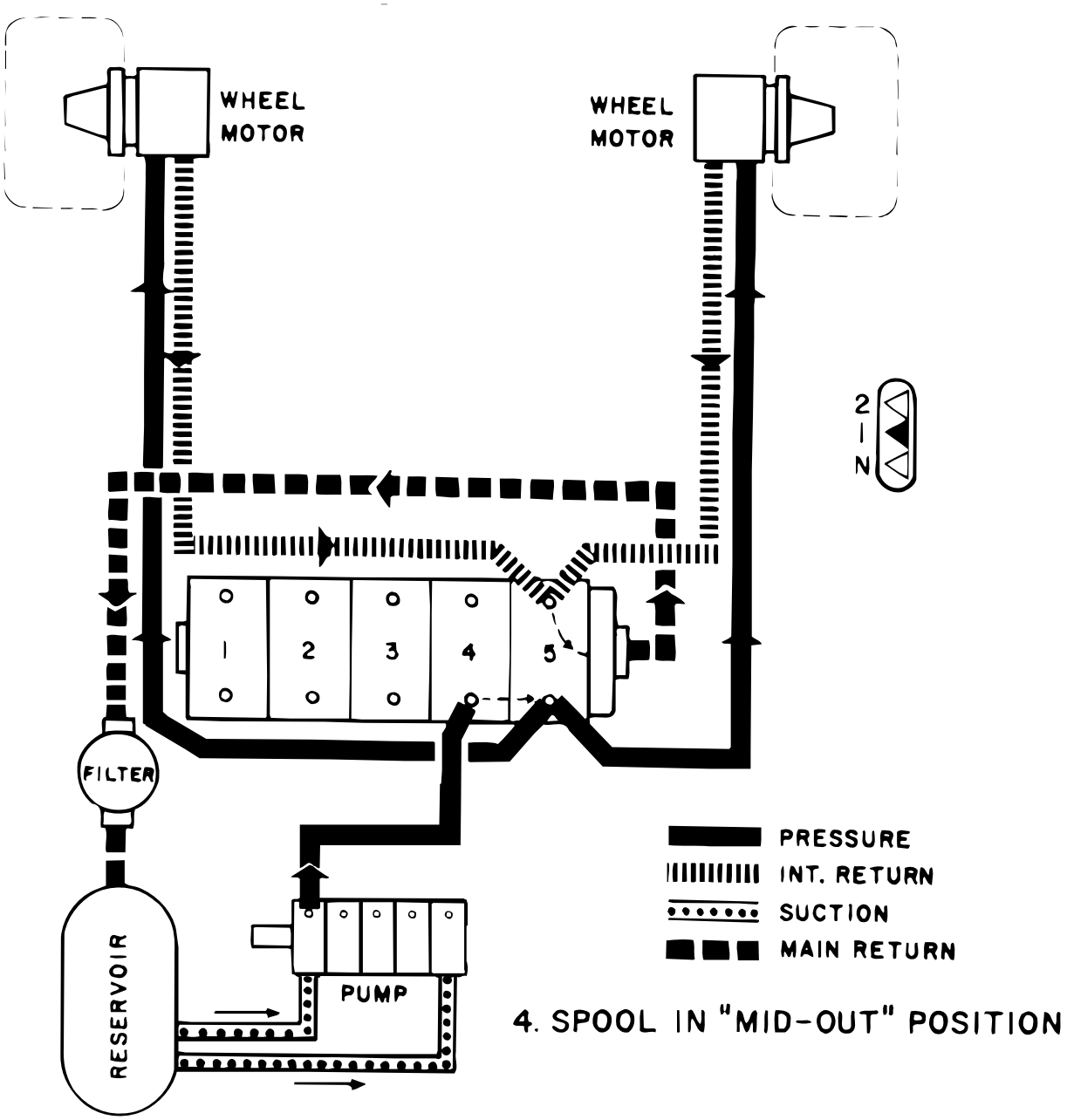


Figure 5

Hydraulic Flow Diagrams

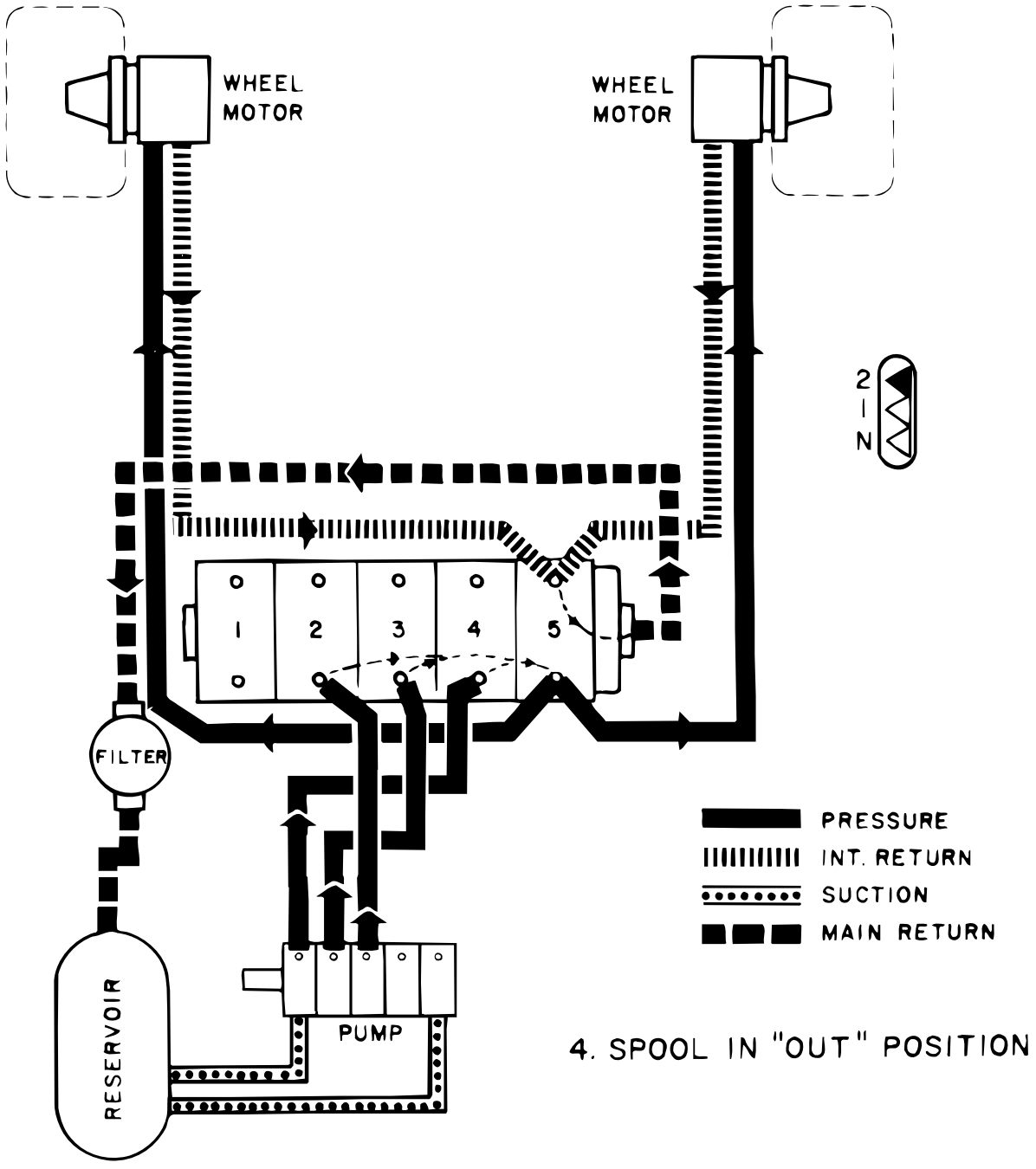
Traction, No. 1 Position

When engine is started, pump draws oil from reservoir through two suction lines. Oil from one section of pump passes through fitting in No. 4 spool valve into valve. Traction lever, when located in No. 1, positions spool so oil is directed to flow into the No. 5 metering valve section. When the traction pedal is pushed forward oil flows out lines at rear of metering valve section to each motor to drive the motors. Low pressure oil returns to valve through valve and main return line, through filter to reservoir.



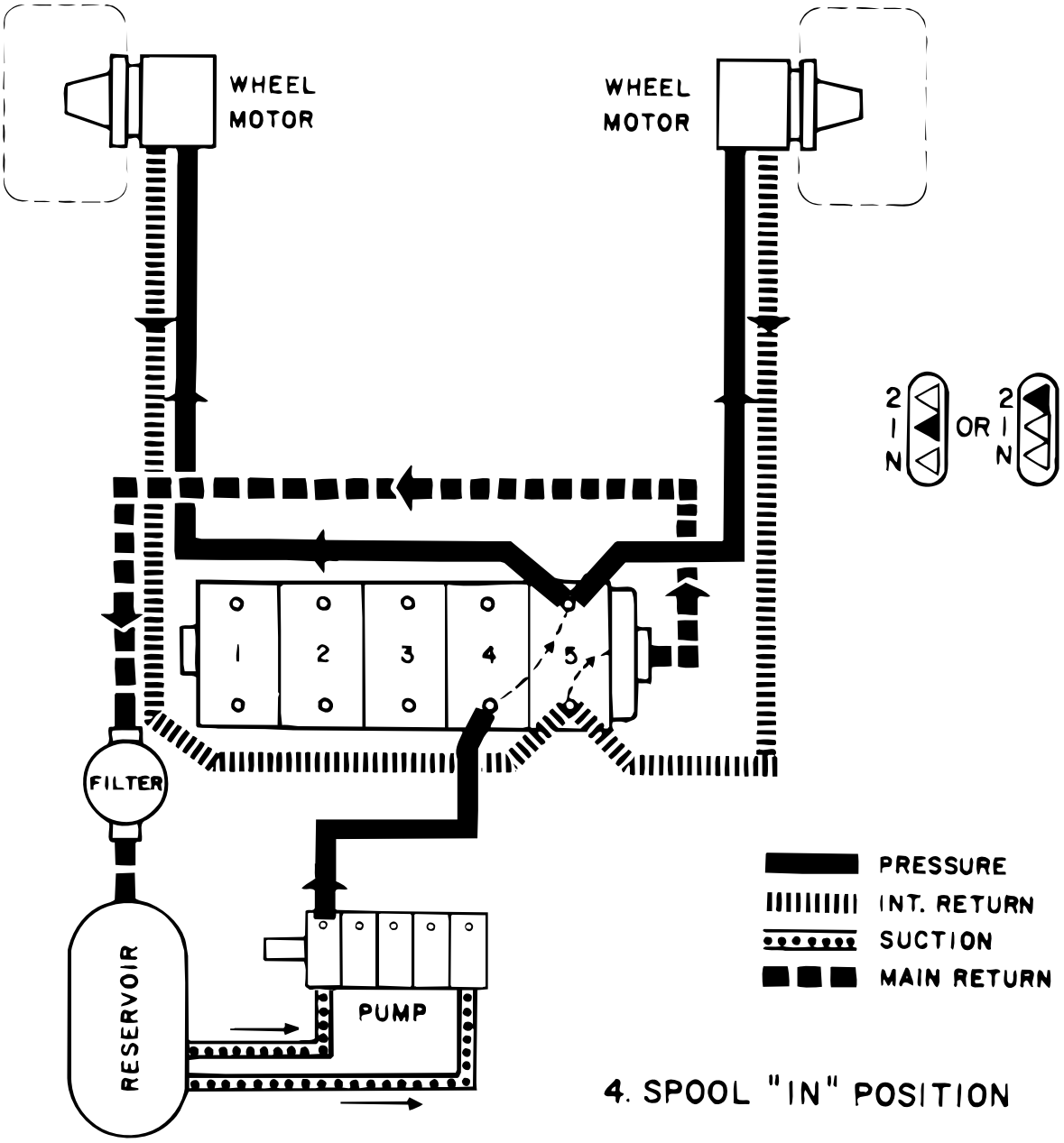
Traction, No. 2 Position

When the traction lever is positioned in No. 2, flow from one pump section passes through same lines as for No. 1 traction position. This flow is joined by additional flow from two other pump sections. The additional flow increases the RPM of the wheel motors to increase ground speed.



Traction, Reverse Position

Traction lever is positioned in No. 1 or No. 2. When traction pedal is pushed rearward, flow from one pump section goes through No. 4 selector valve section into No. 5 metering section and out the lines at the front of the valve to the traction motors, which drive the traction wheels, to operate in reverse.

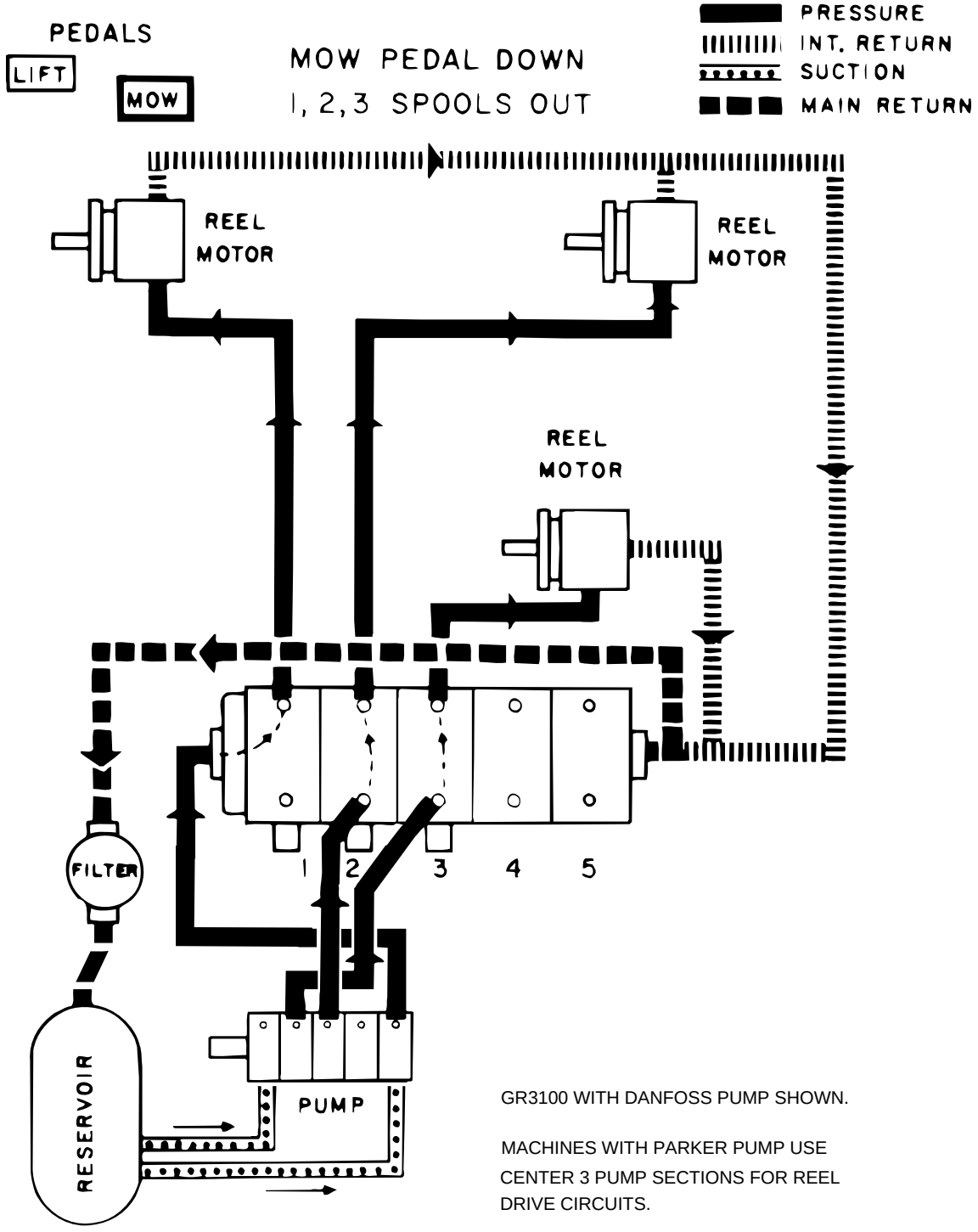


Reel Drive, Mowing Operation

The MOW pedal is depressed, which causes the No. 1, 2 and 3 spools to be positioned fully out of valve bank. This directs flow from one pump section to pass through left end cover and out line leading to left front cutting unit drive motor. Flow causes motor to turn, driving reel.

Flow from separate pump section passes through No. 2 valve section and out a line to right front cutting unit motor. Return oil from two front cutting units joins together and returns to right end of valve section, where is passes into the main return line and flows back to reservoir.

Flow from another separate pump section passes through No. 3 spool section and out through a line to the rear cutting unit drive motor. Return oil from the motor passes through a line leading to the right hand end of the valve bank, where it also joins with the main return line back to the reservoir.

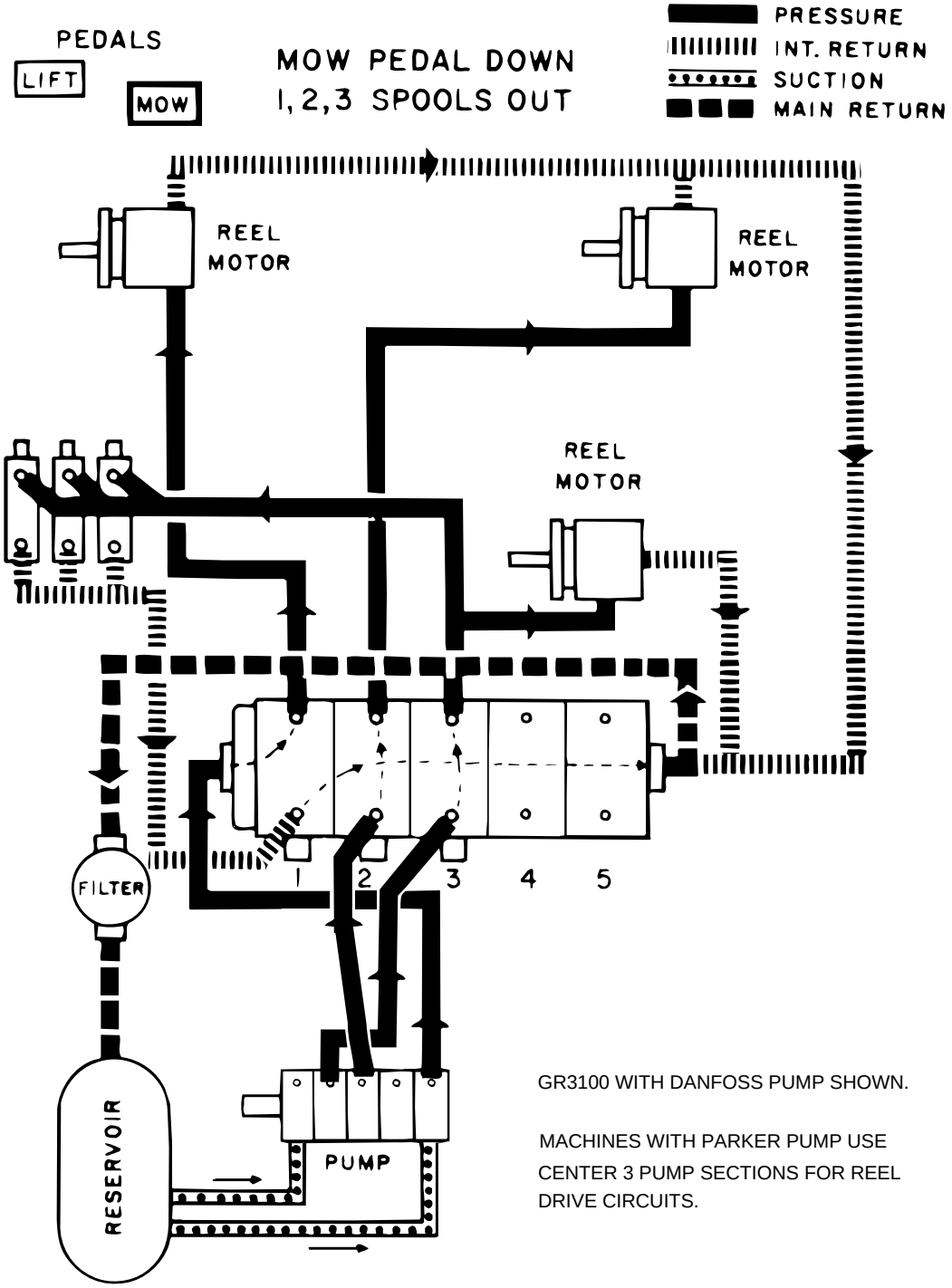


GR3100 WITH DANFOSS PUMP SHOWN.

MACHINES WITH PARKER PUMP USE CENTER 3 PUMP SECTIONS FOR REEL DRIVE CIRCUITS.

Reel Drive, Lower Cutting Units

The MOW pedal is depressed to start reel drive operation, flow from one pump section passes through No. 3 spool section and out three lines, each leading to a lift cylinder. This actuates the lift cylinders and lowers the cutting units. Oil is returned to a three-way fitting on the No. 1 spool section through lines on the top end of each cylinder, where it passes through the valve section and returns to the reservoir through the main return line. When the cylinders complete their travel, oil flow from the No. 3 spool section is then directed to the rear cutting unit drive motor.

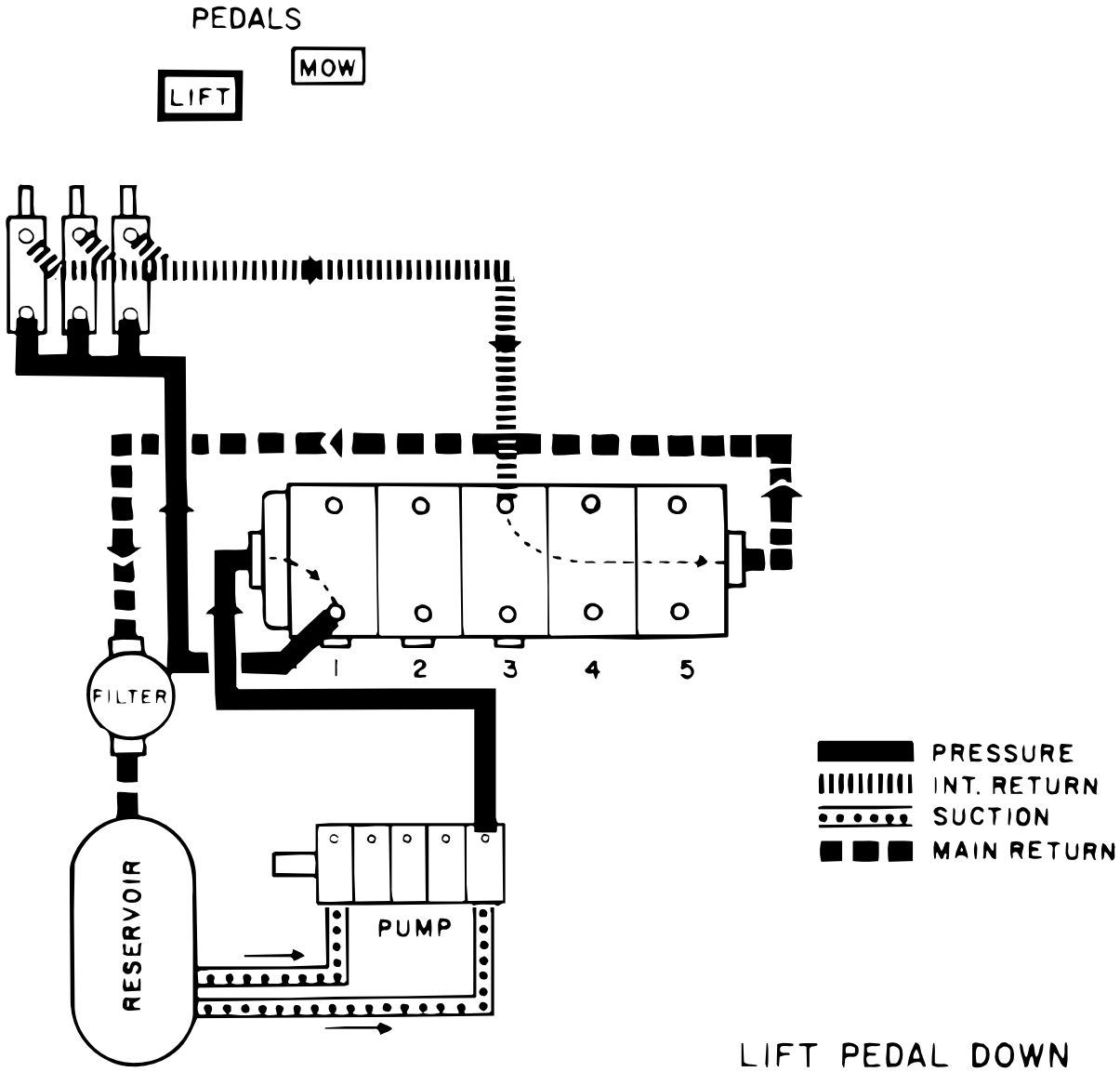


GR3100 WITH DANFOSS PUMP SHOWN.

MACHINES WITH PARKER PUMP USE CENTER 3 PUMP SECTIONS FOR REEL DRIVE CIRCUITS.

Reel Drive, Raising Cutting Units

When the LIFT pedal is depressed, No. 1, 2 and 3 spools are pushed inward. When spools pass neutral, cutting units stop operation. Holding pedal depressed keeps spools fully in. This directs flow from one pump section to pass through end cover and No. 1 spool valve, out three lines leading to lift cylinders, causing cylinders to raise the cutting units. Oil forced out of cylinders travels through lines leading to No. 3 spool section, through the valve bank and back to reservoir through main return line.



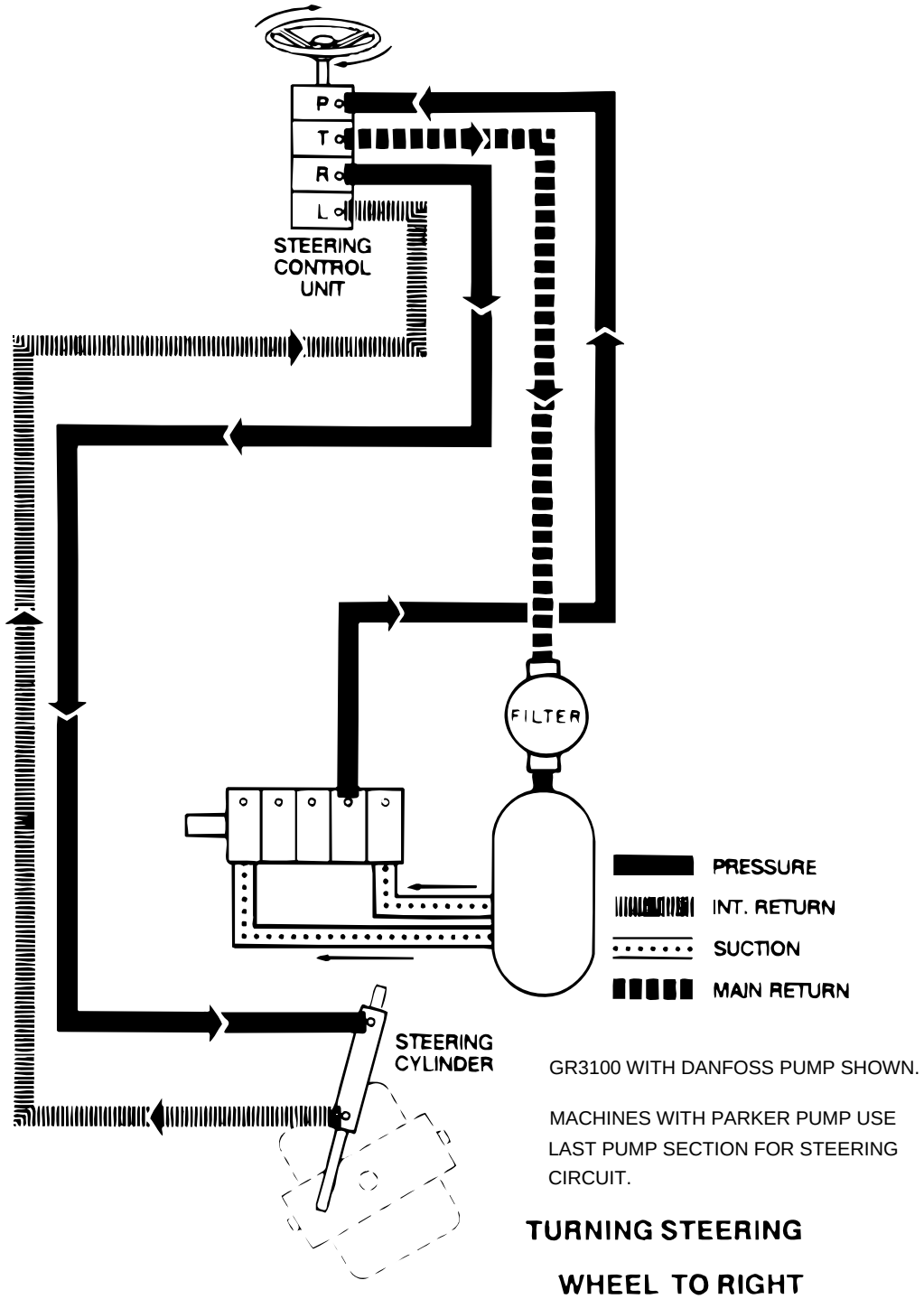
GR3100 WITH DANFOSS PUMP SHOWN.

MACHINES WITH PARKER PUMP USE FOURTH PUMP SECTION FOR LIFT.

Power Steering, R.H. Turn (Greensmaster 3100)

Oil is supplied to port “P” of the steering control unit from the pump steering section. When the steering wheel is turned to the right, the control section within the steering valve shifts to direct oil supplied by the pump to the metering section of the steering valve. As the steering wheel turns, system oil is metered out port “R” to the steering cylinder. Oil displaced by the other end of the steering cylinder returns to the steering valve through port “L” which directs it out port “T” back to reservoir.

When the steering wheel stops turning, the control section within the steering valve shifts back to neutral allowing all oil from the pump to flow through the steering valve out port “T” back to reservoir. Oil in the rest of the steering circuit is then trapped.



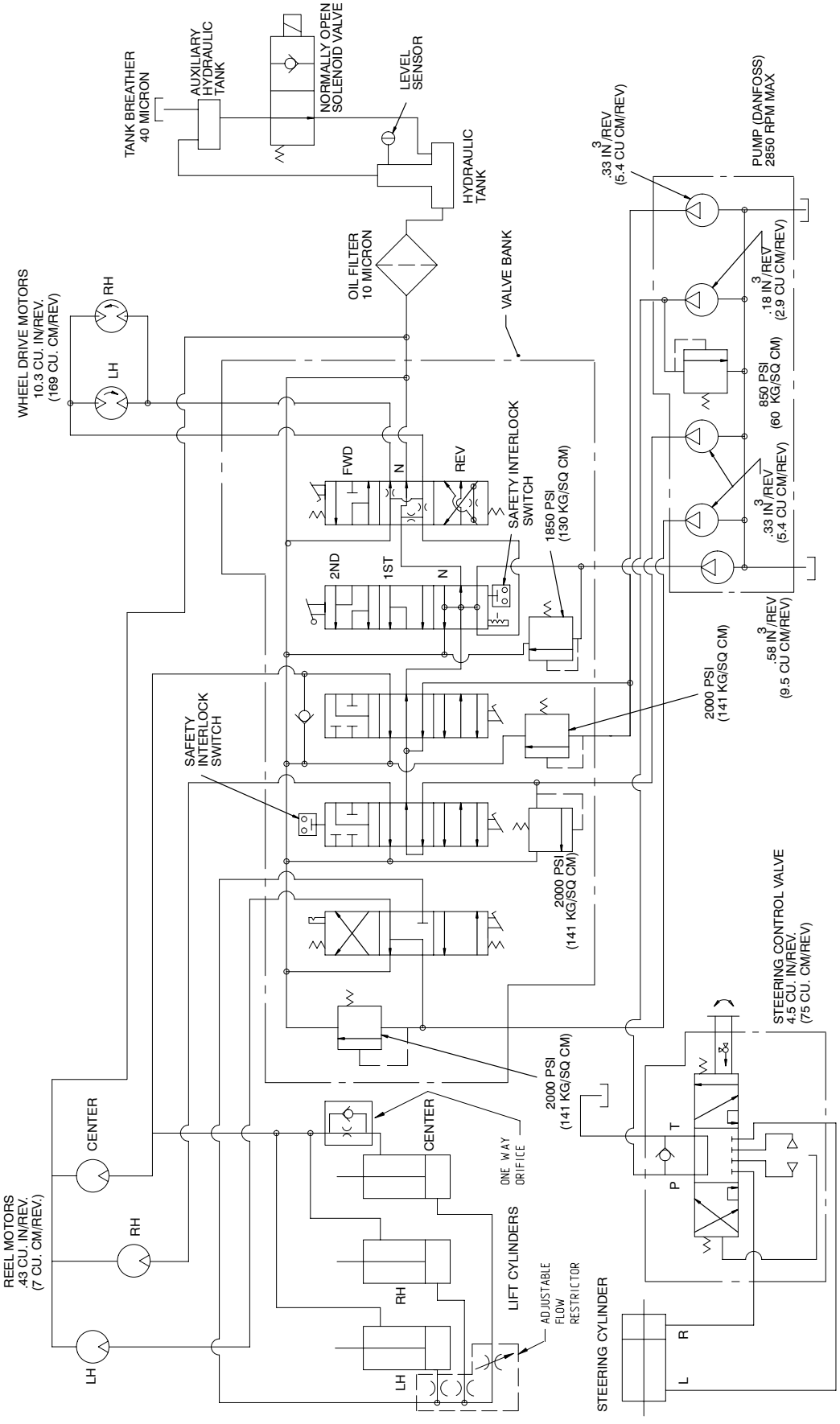
GR3100 WITH DANFOSS PUMP SHOWN.

MACHINES WITH PARKER PUMP USE LAST PUMP SECTION FOR STEERING CIRCUIT.

TURNING STEERING WHEEL TO RIGHT

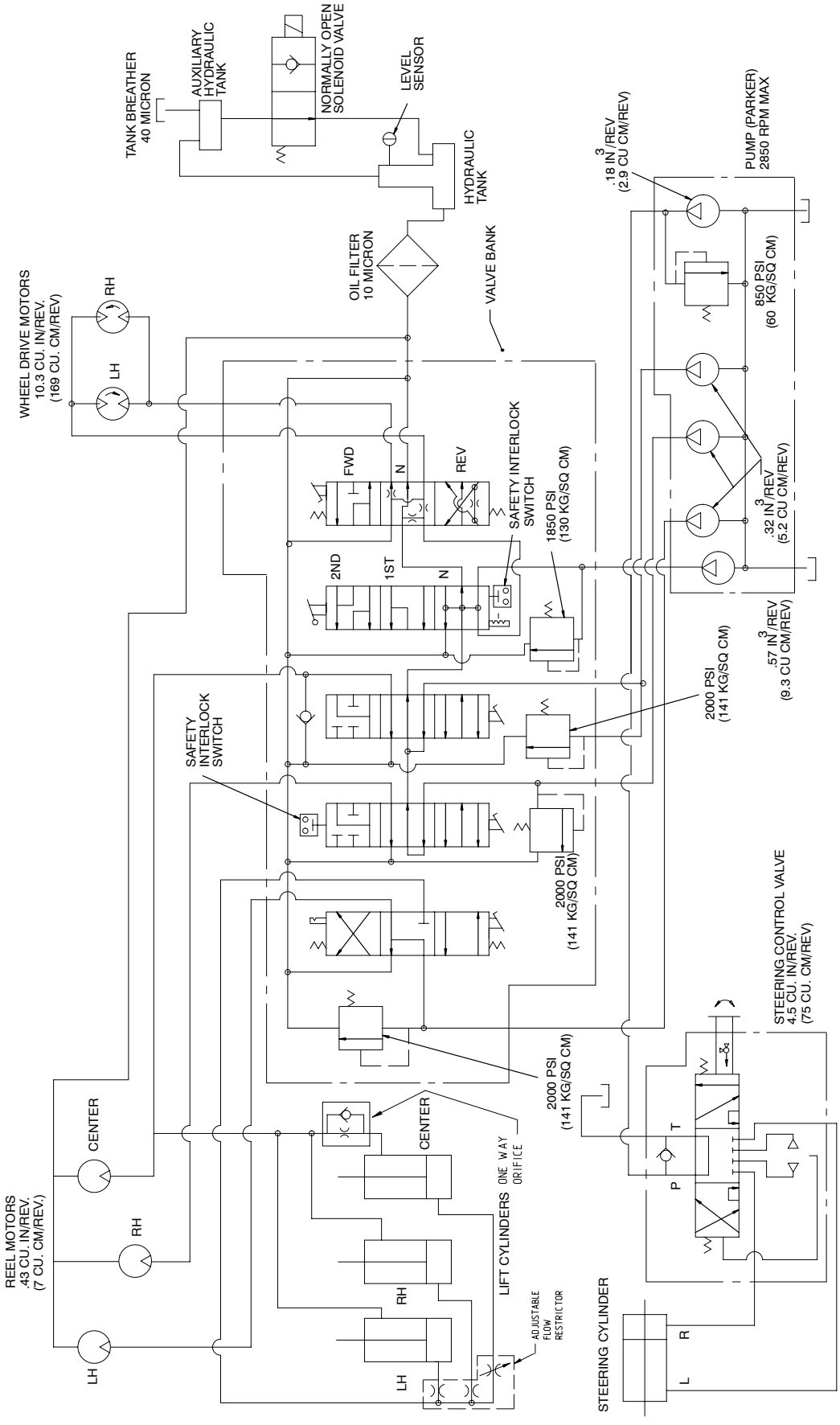
Hydraulic Schematic

(Greensmaster 3100 2WD Serial Number Below 230000000)

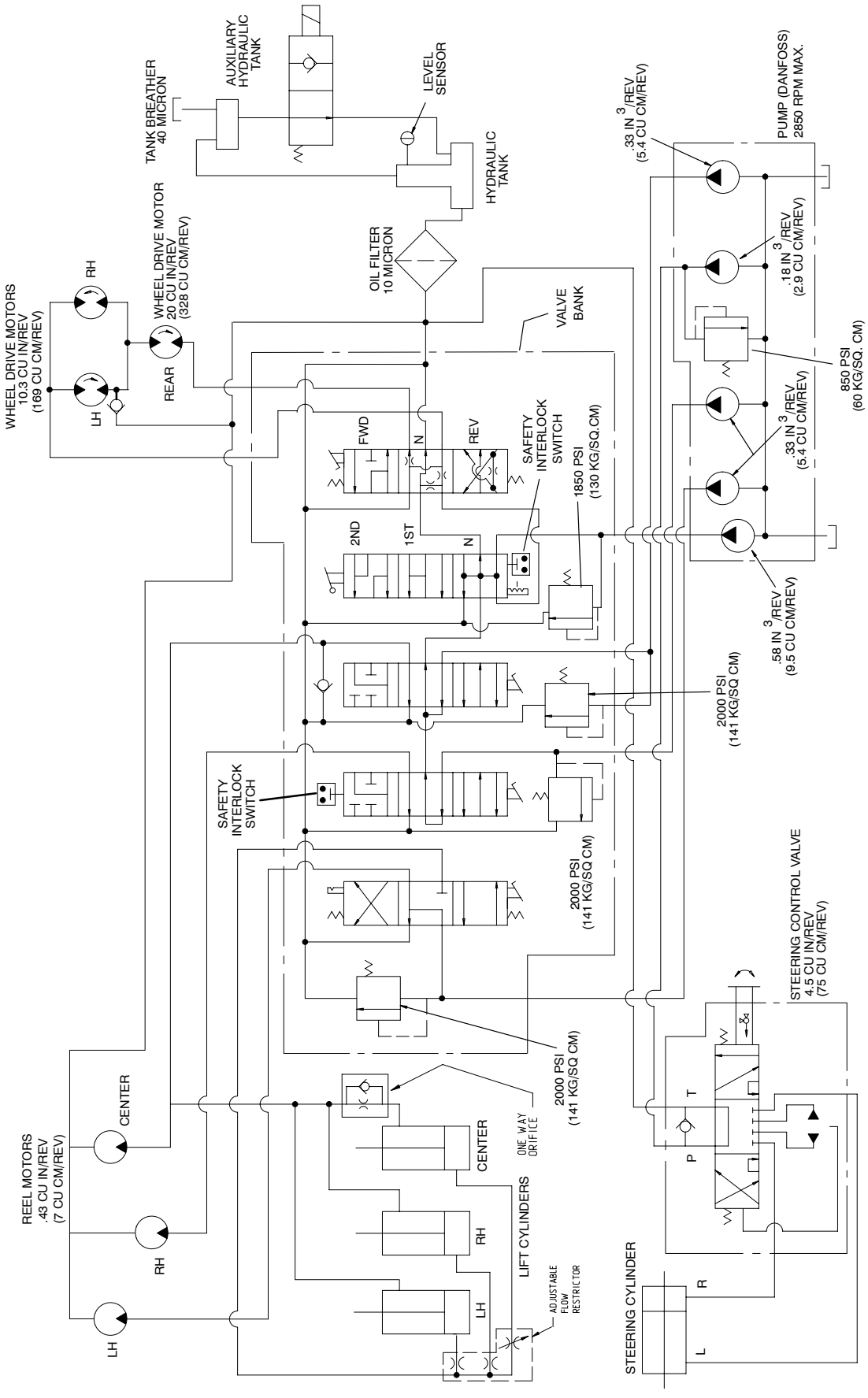


Hydraulic Schematic

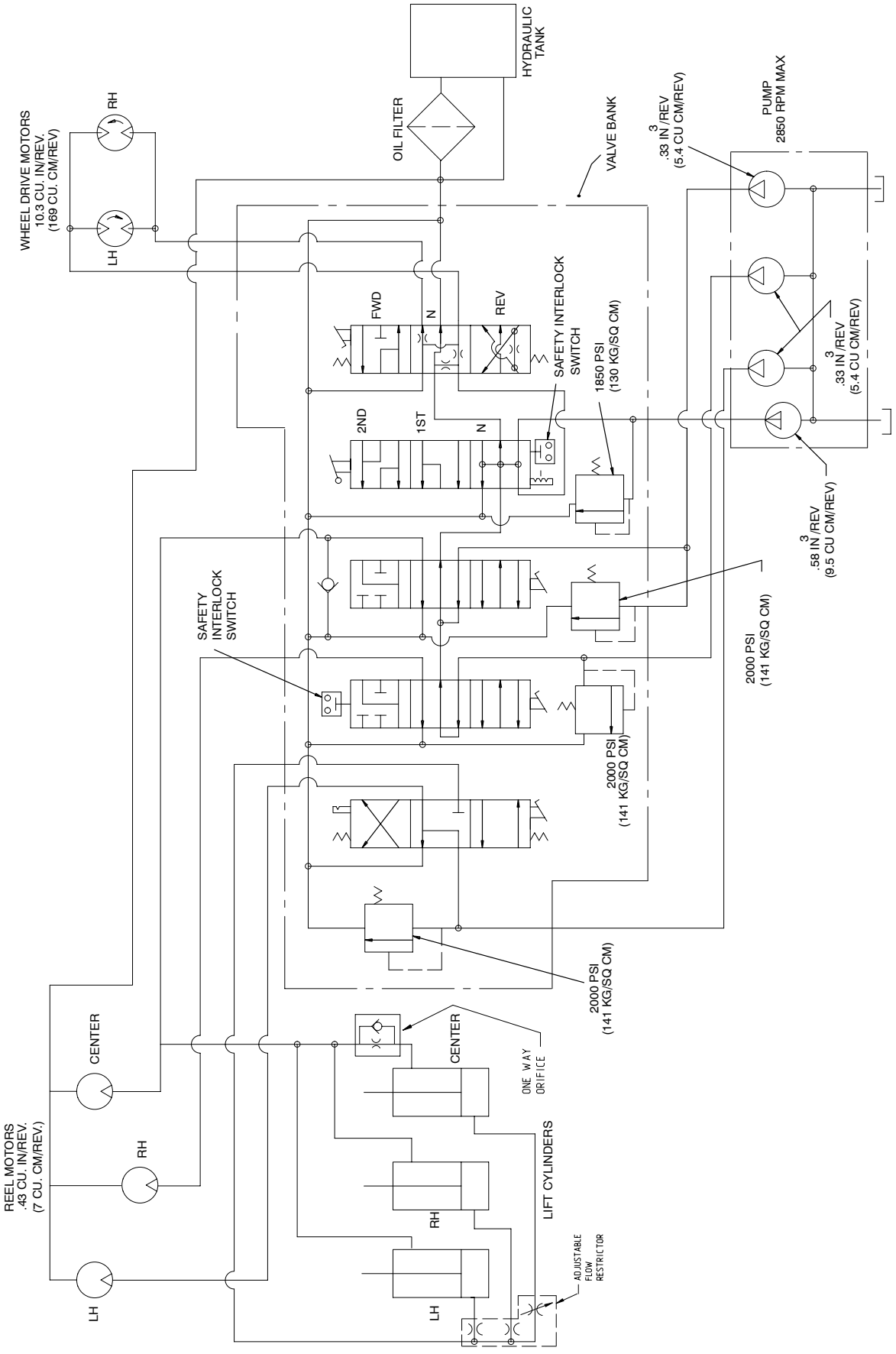
(Greensmaster 3100 2WD Serial Number Above 230000000)



Hydraulic Schematic (Greensmaster 3100 3WD)



Hydraulic Schematic (Greensmaster 3050)



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Special Tools

NOTE: Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*. Some tools may be listed in the Greensmaster 3100 Parts Catalog. Some tools may also be available from a local supplier.

Hydraulic Tester (Fig. 6)

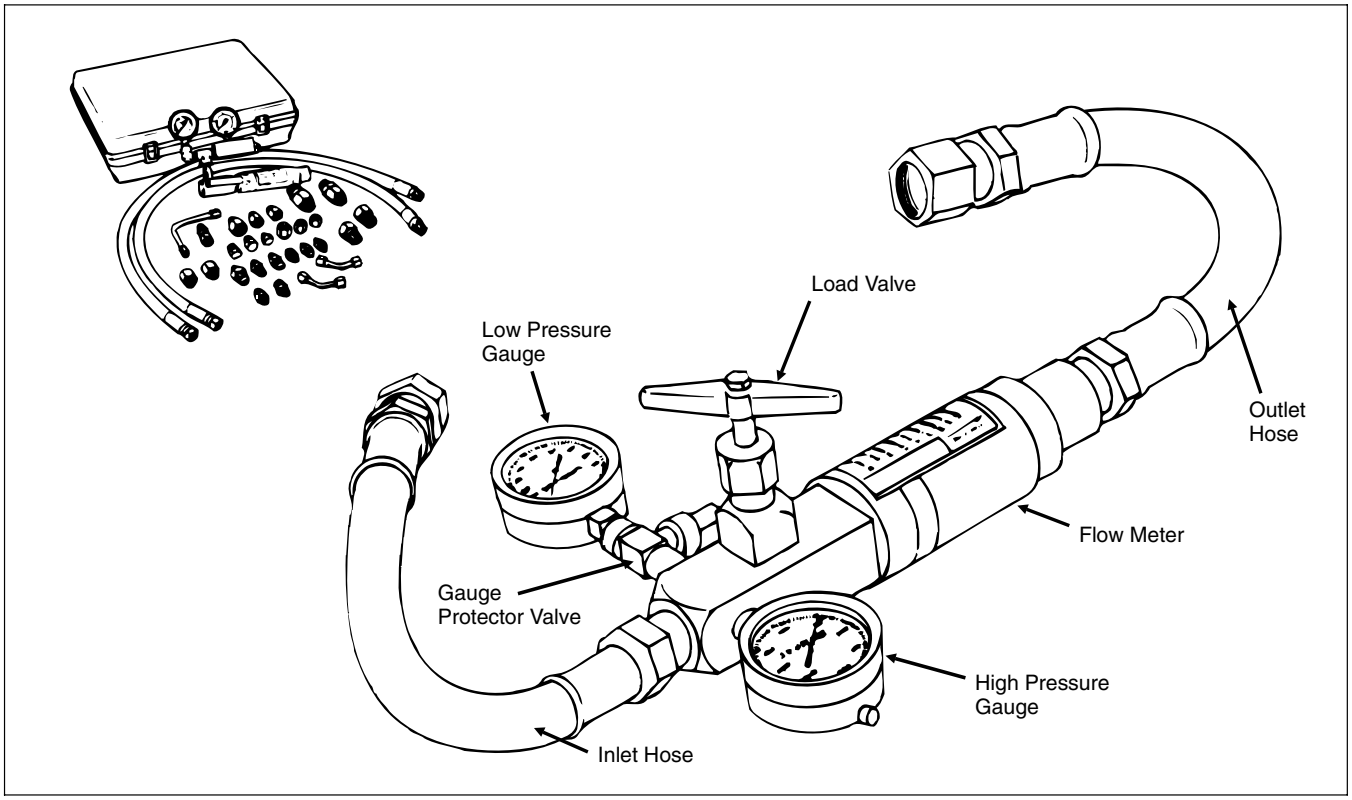


Figure 6

You must have o-ring face seal (ORFS) adapter fittings for this tester to use it on the Greensmaster 3100.

1. INLET HOSE: Hose connected from the system circuit to the inlet side of the hydraulic tester.

2. LOAD VALVE: If required, upon turning the valve to restrict flow, a simulated working load is created in the circuit.

3. LOW PRESSURE GAUGE: Low range gauge to provide accurate reading at low pressure, 0 - 1000 psi (0 - 6895 kPa).

   This gauge has a protector valve which cuts out when pressure is about to exceed the normal range for the gauge. The cutout pressure is adjustable.

4. HIGH PRESSURE GAUGE: High range gauge to accommodate pressure beyond the capacity of the low pressure gauge, 0 - 5000 (0 - 34475 kPa).

5. FLOW METER: This meter measures actual oil flow in the operation circuit. The reading is given in gallons per minute (GPM) and liters per minute (LPM) with a gauge rated at 15 GPM (57 LPM).

6. OUTLET HOSE: Hose from the outlet side of the hydraulic tester to be connected to the hydraulic system circuit.

Seal Protector (Fig. 7)

Slide the protector (Item 1) over the reel motor shaft before installing the shaft seal to protect the seal from damage. Apply a light coating of clean oil to the seal protector to ease movement of the seal over the tools. Use the installer (Item 2) and a small hammer to drive the reel motor shaft seal into position in the bore of the reel motor body.

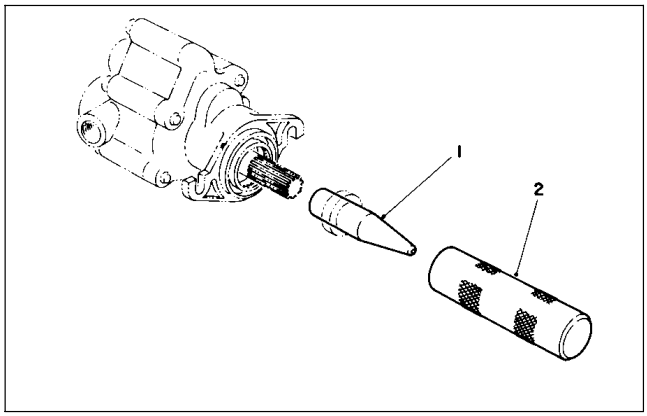


Figure 7

Detent Installation Tool (Fig. 8)

Use this tool with a 3/8 in. drive torque wrench to tighten the detent stud in the No. 1 spool of the control valve. Apply Loctite 222 or equivalent to the threads of the detent stud. Tighten the stud to a torque of 10 - 14 ft-lb.

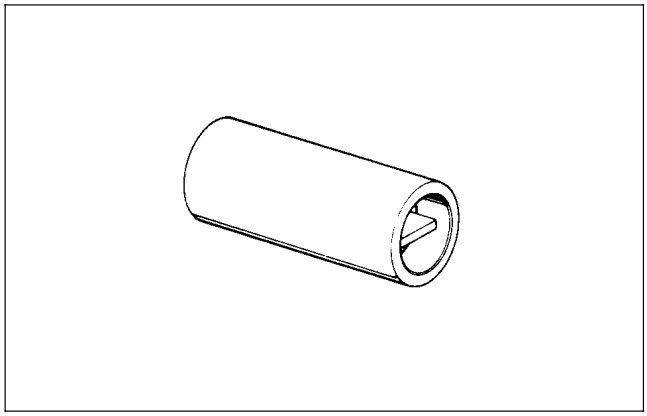


Figure 8

Seal Installation Tool (Fig. 9)

Use to assure proper fit and positioning of lip seals used in the TRW Torqmotor hydraulic wheel motor. Put the seal inside the ring (Item 2) with the seal lip toward the motor. Slide the main tube (Item 1) of the tool into the ring. Put the tool into position in the bore of the motor housing. Tap against the main tube of the tool to seat the seal.

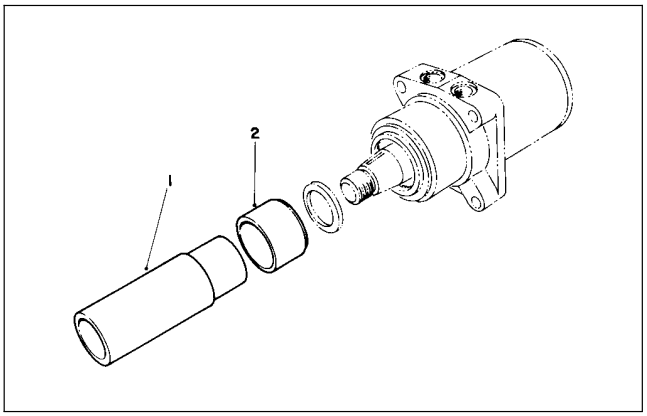


Figure 9

Assembly Studs (Fig. 10)

Use for proper alignment of internal parts during disassembly and repair of the TRW Torqmotor hydraulic wheel motor.

IMPORTANT: The wheel motor geroters are indexed and must be kept in their original position.

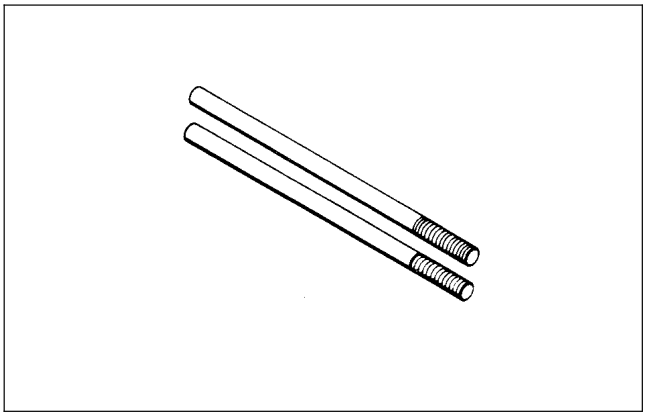


Figure 10

Control Valve Spool Seal Installation Tools (Fig. 11)

This tool can be made to the dimensions shown.

Soak new seal in clean hydraulic fluid before installing. Install seal into end of large diameter tool with open side of seal facing out. Install small diameter tool into large diameter tool against flat (closed) side of seal. Carefully install seal and tools over valve spool, hold large tool against valve body and push seal into bore with small diameter tool.

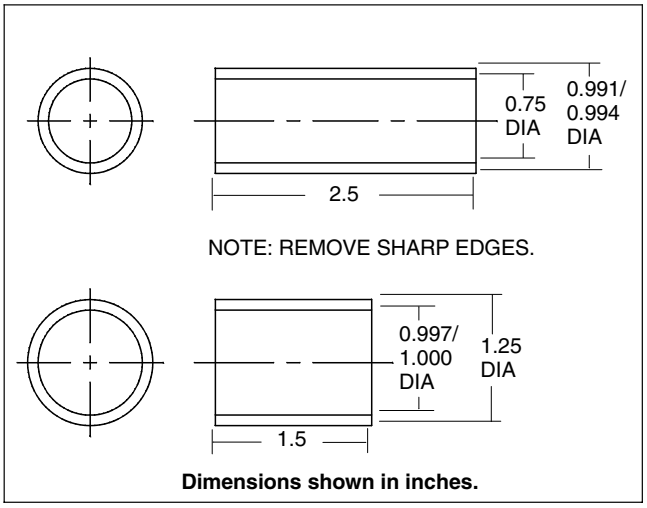


Figure 11

Troubleshooting

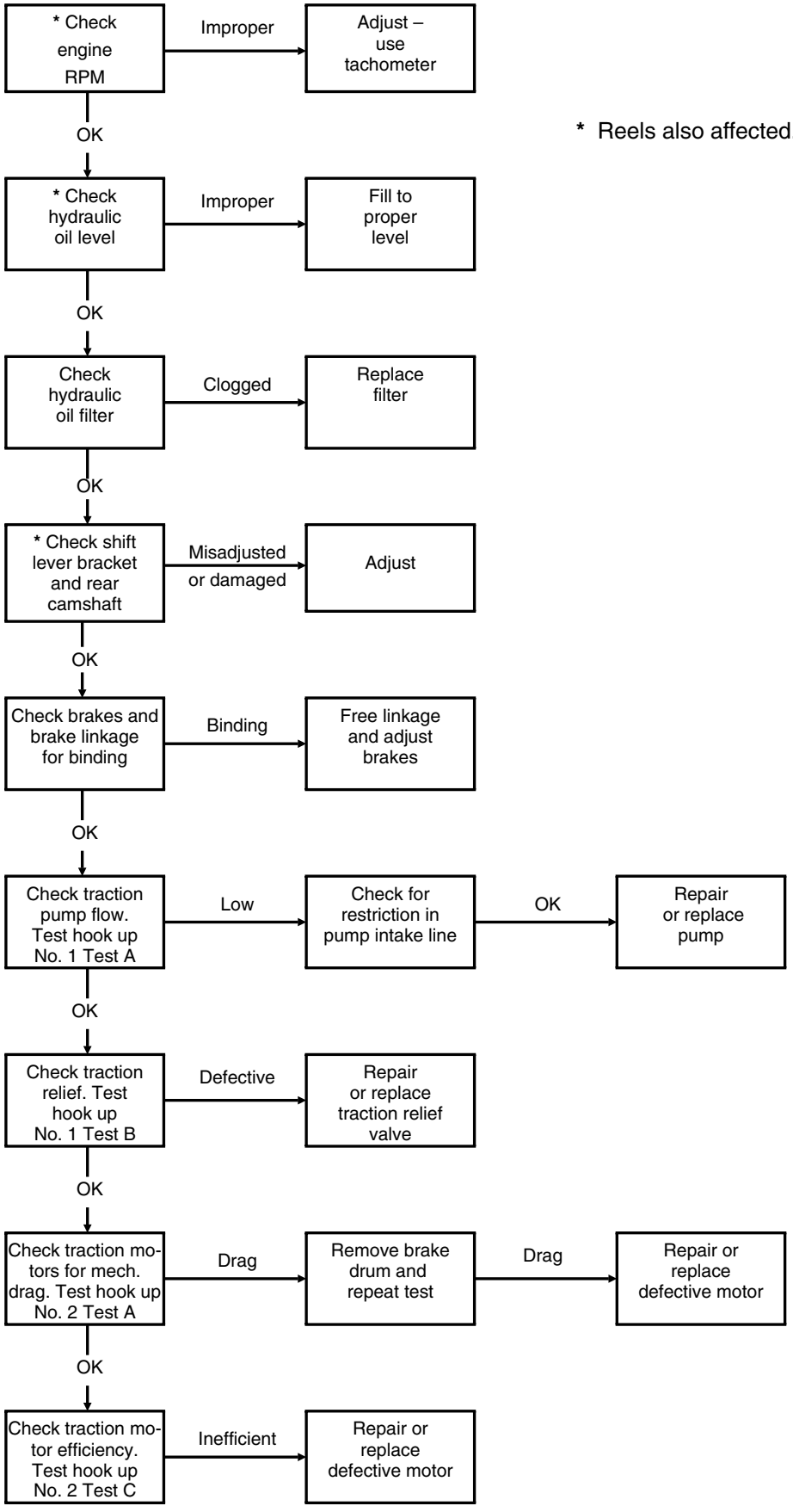
The cause of an improperly functioning hydraulic system is best diagnosed with the use of proper testing equipment and a thorough understanding of the complete hydraulic system.

A hydraulic system with an excessive increase in heat or noise is a potential failure. Should either of these conditions be noticed, immediately stop the machine, turn off the engine, locate the cause of the trouble, and correct it before allowing the machine to be used again. Continued use of an improperly functioning hydraulic system could lead to extensive internal component damage.

The charts that follow contain detailed information to assist in troubleshooting. There may possibly be more than one cause for a machine malfunction. All causes should be checked in the order in which they are listed on the charts; do not deviate from this procedure.

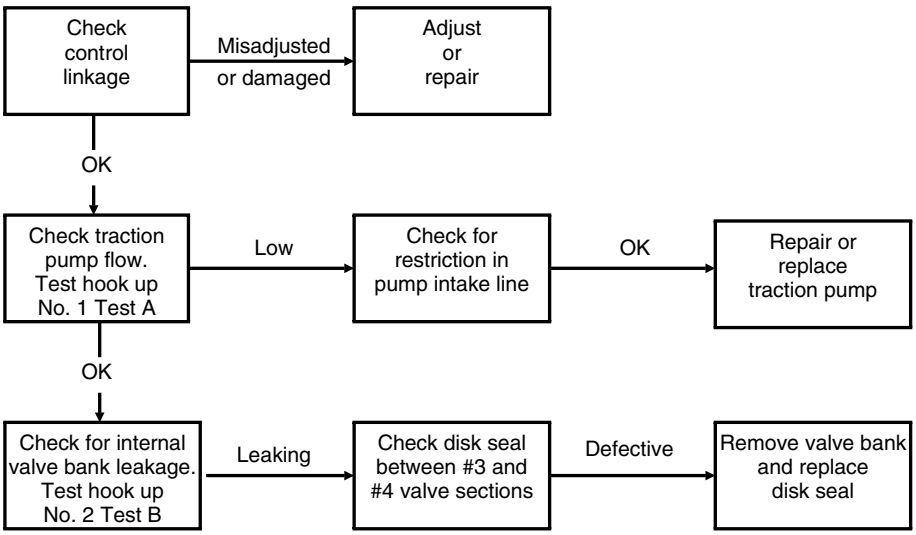
Refer to the Testing section of this Chapter for precautions and specific test procedures.

Slow Groundspeed in All Traction Selections

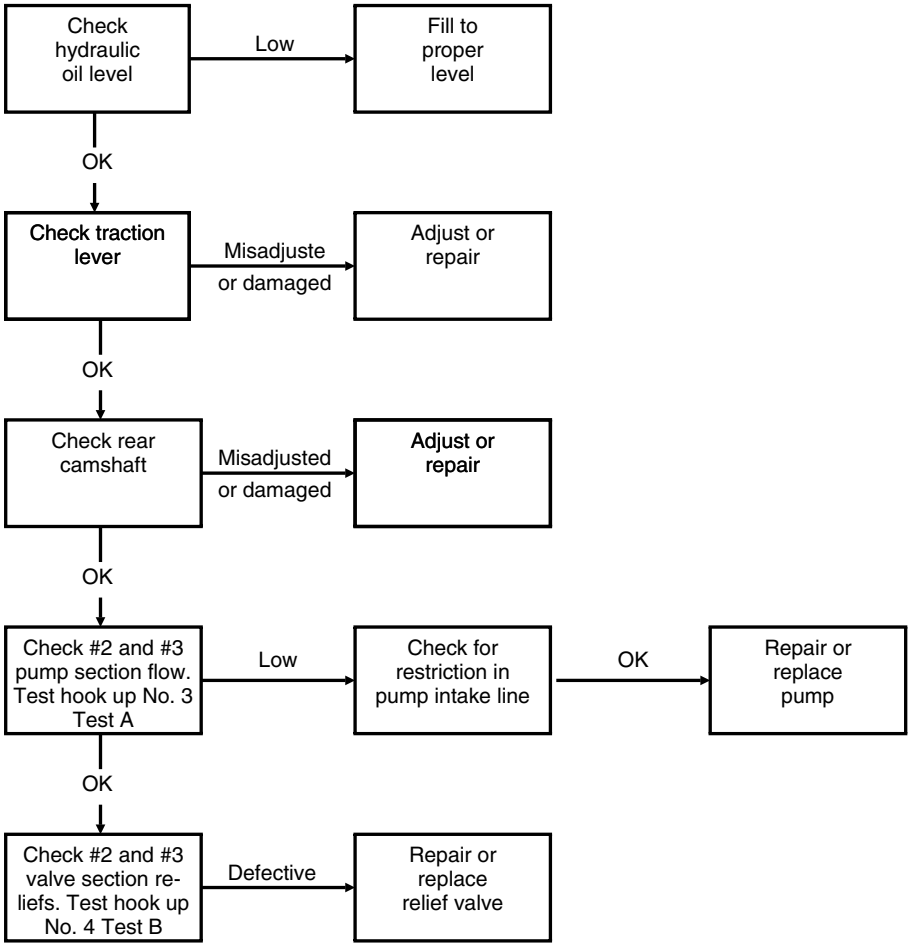


***** Reels also affected.

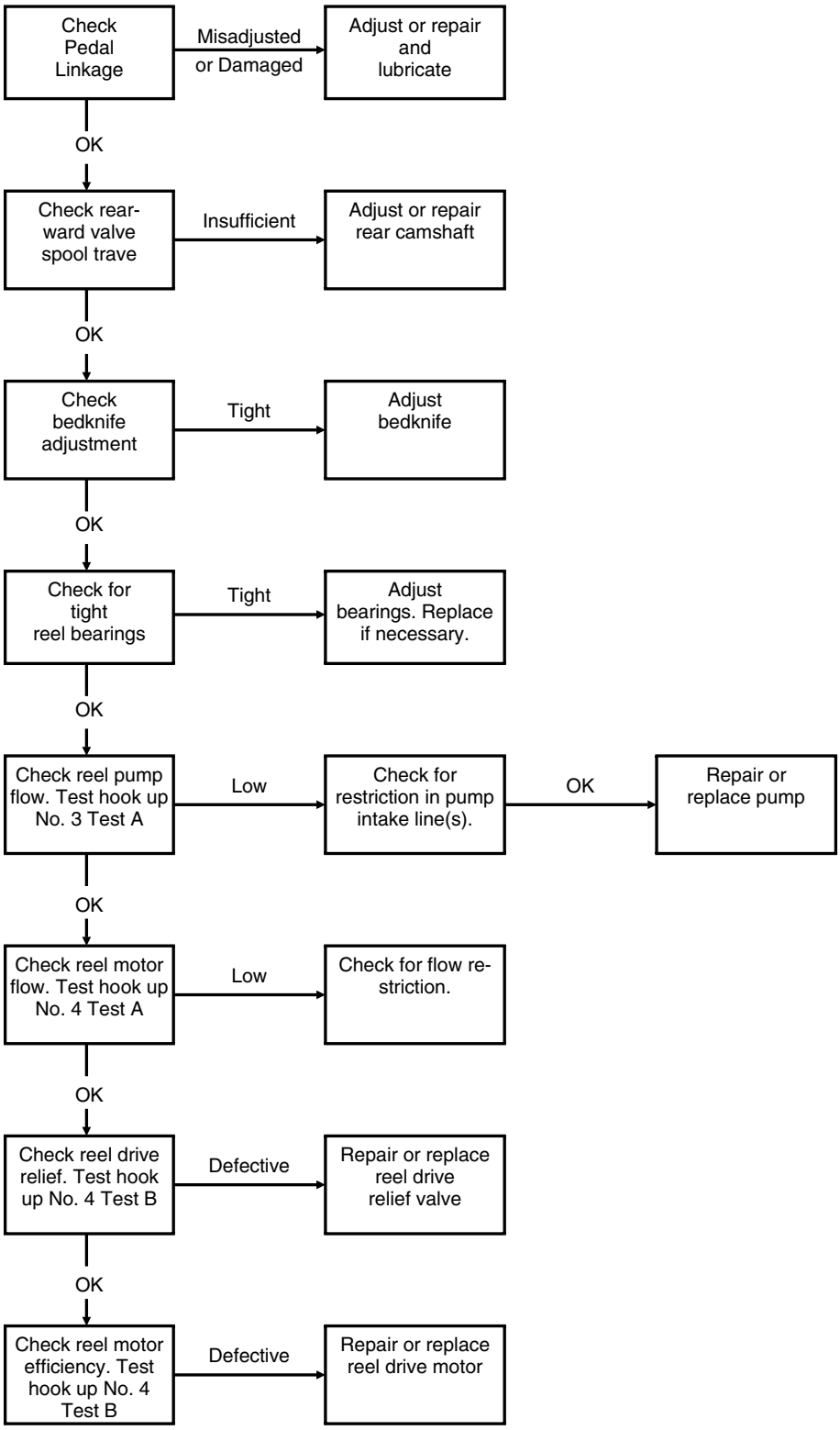
Slow or No Ground Speed in No. 1 and Reverse No. 2 Appears Normal



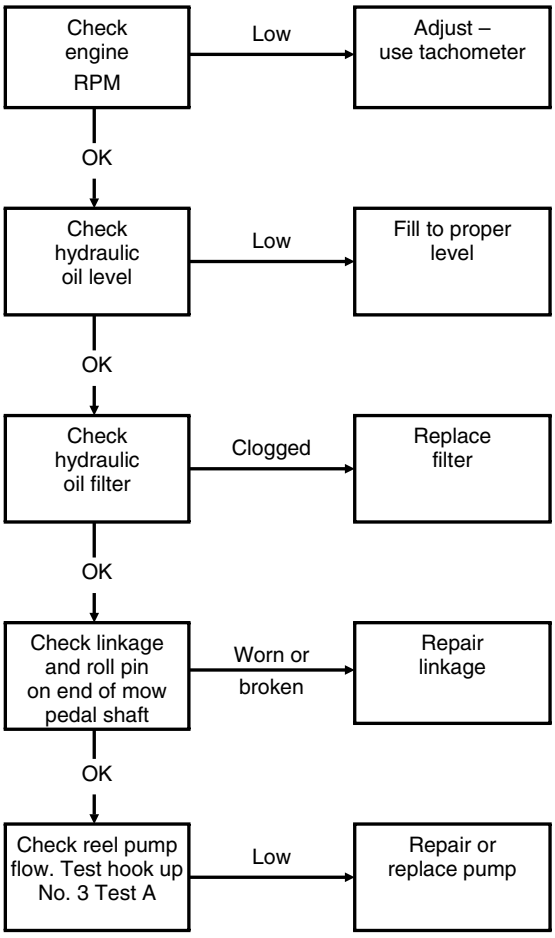
No Increase in Speed from No. 1 to No. 2



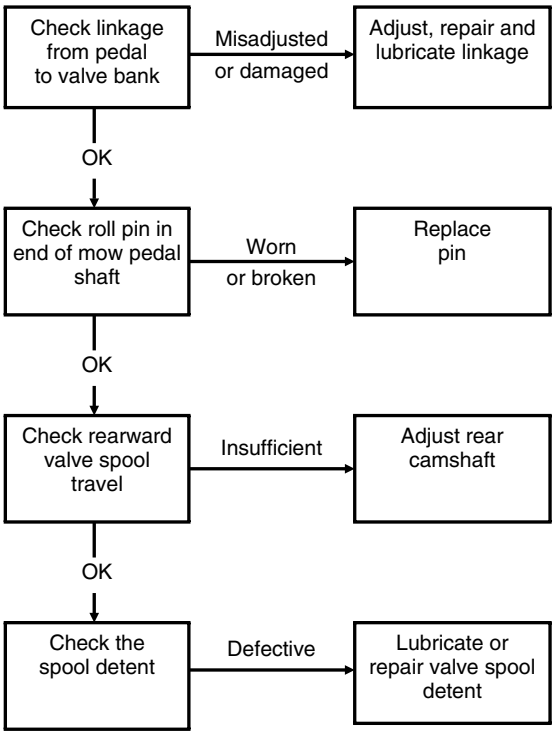
One or More Cutting Units Slow or No Reel Drive Action



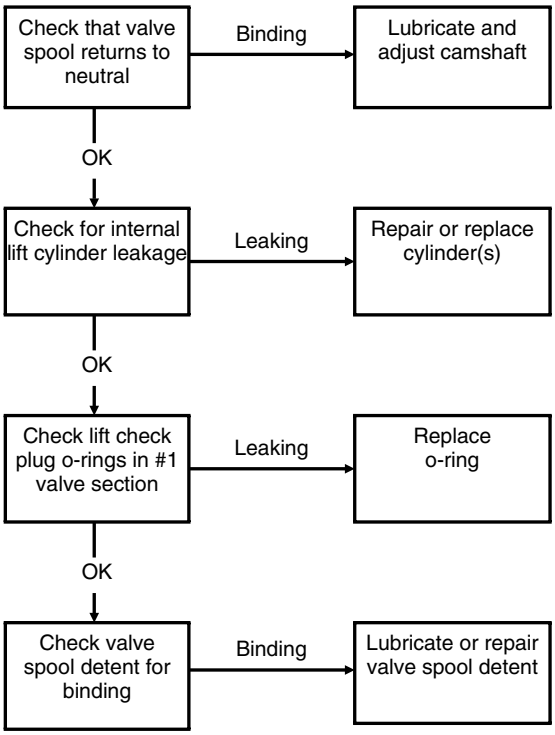
All Reels Slow or Will Not Turn



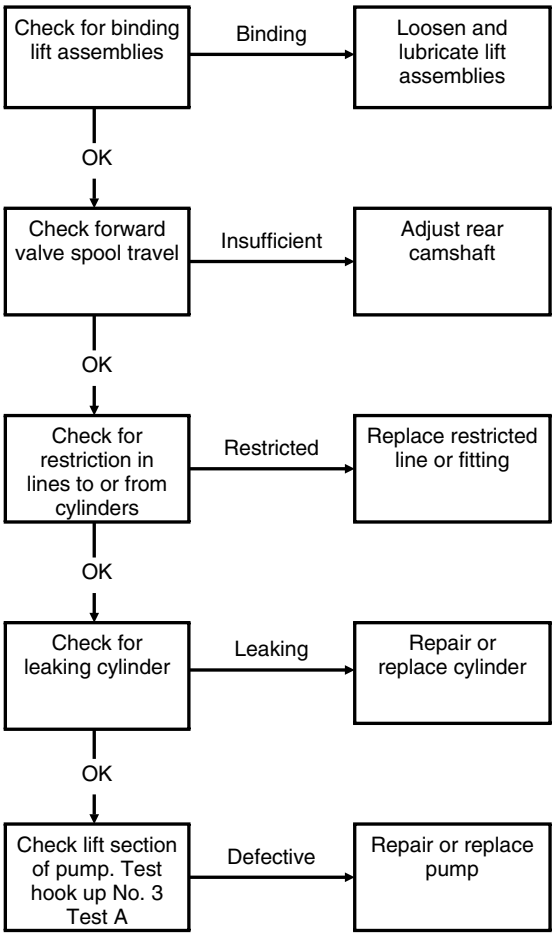
Mow Pedal Won't Stay Engaged – Reels Slow Down or Stop



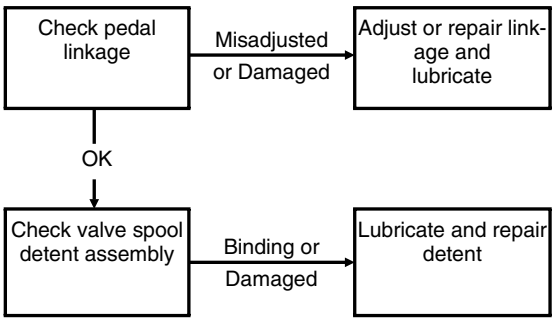
Cutting Unit(s) Drop During Transport



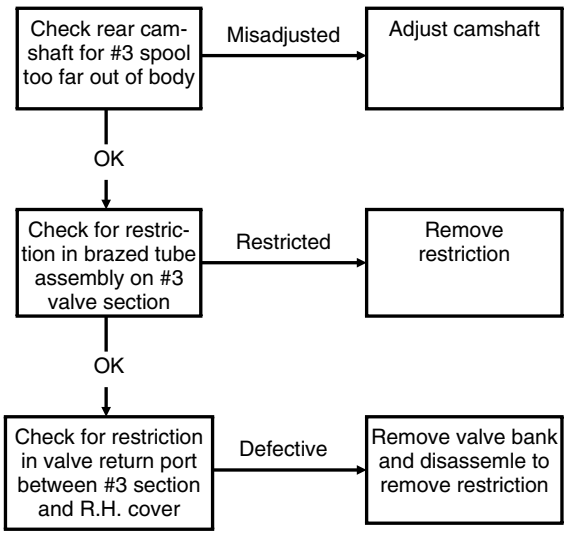
Cutting Units Lift Too Slowly or Not At All



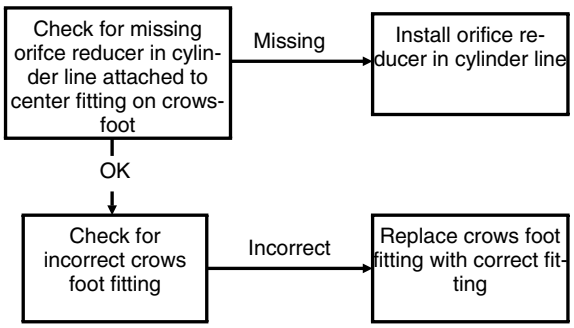
Lift Pedal Binding



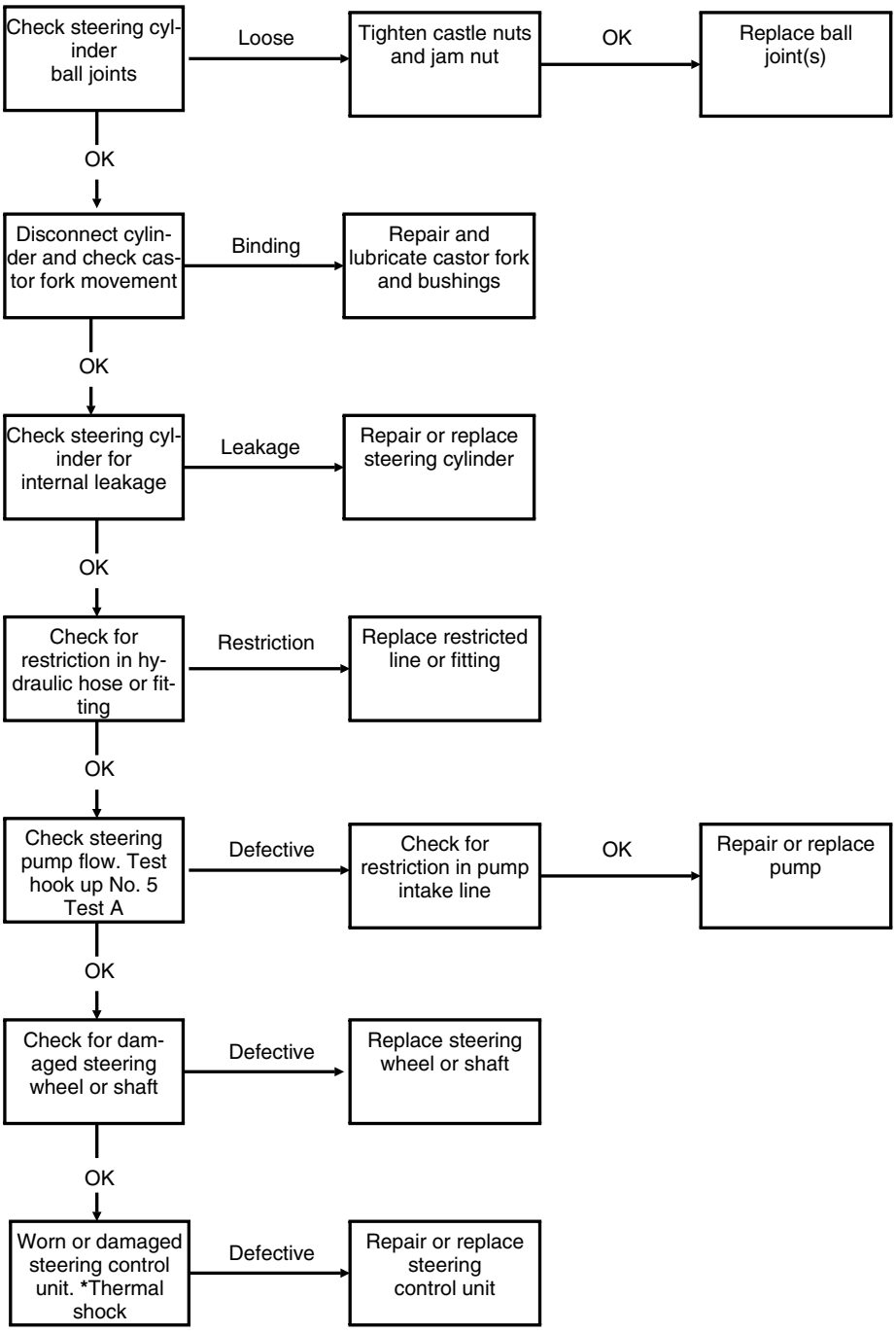
Center (#1) Cutting Unit Operates in Raised Position



Center (#1) Cutting Unit Drops Before Front Cutting Units or Drops Too Fast



Steering Loss, Steering Wander or Free Play



***** Thermal shock - A condition caused when the hydraulic system is operated for some time without turning the steering wheel so that fluid in the reservoir and system is hot and the steering control unit is relatively cool (more than 50^{o} F temperature differential). This can also happen when washing the machine. When the steering wheel is turned quickly the result is temporary seizure and possible damage to internal parts of the steering control unit. The temporary seizure may be followed by total free wheeling.

Testing

The most effective method for isolating troubles in the hydraulic system is by using hydraulic test equipment such as pressure gauges and flow meters in the circuits during various operational checks. (See the Special Tools section in this Chapter.)

Hydraulic testers may vary significantly in size, construction, accuracy, and cost. The decision as to which tester to purchase should be influenced by what type of tests will be performed on all of the hydraulically-powered equipment in the shop.

All obvious areas such as oil supply, filter, binding linkage, loose fasteners, or improper adjustments must be checked before assuming that a hydraulic component is the source of the problem being experienced.

WARNING

Before disconnecting or performing any work on the hydraulic system, all pressure in the system must be relieved by stopping the engine and lowering the implement to the ground.

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate skin and do serious damage. If fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result.

Before Performing Hydraulic Tests

1. Thorough clean the machine before disconnecting or disassembling any hydraulic components. Always keep in mind the need for cleanliness when working on hydraulic equipment.

2. Put caps or plugs on any hydraulic lines left open or exposed during testing or removal of components.

3. The engine must be in good operating condition. ALWAYS use a tachometer when making a hydraulic test. Engine speed will affect the accuracy of the tester readings.

4. To prevent damage to the tester or components, the inlet and the outlet hoses must be properly connected, and not reversed (tester with pressure and flow capabilities).

5. To minimize the possibility of damaging the components, completely open the load valve by turning it counterclockwise (tester with pressure and flow capabilities).

IMPORTANT: The pump used on the Greensmaster 3100 is a positive displacement type. If its output flow is completely restricted or stopped, damage to the pump or other components could occur.

6. Install fittings finger tight, far enough to insure that they are not cross-threaded, before tightening with a wrench.

7. Position the tester hoses so that rotating machine parts will not make contact with them and result in hose or tester damage.

8. Check the oil level in the reservoir.

9. Check the control linkage for improper adjustment, binding or broken parts.

10. All hydraulic tests should be made with the hydraulic oil at normal operating temperature (hoses warm to the touch).

TEST HOOK UP NO. 1

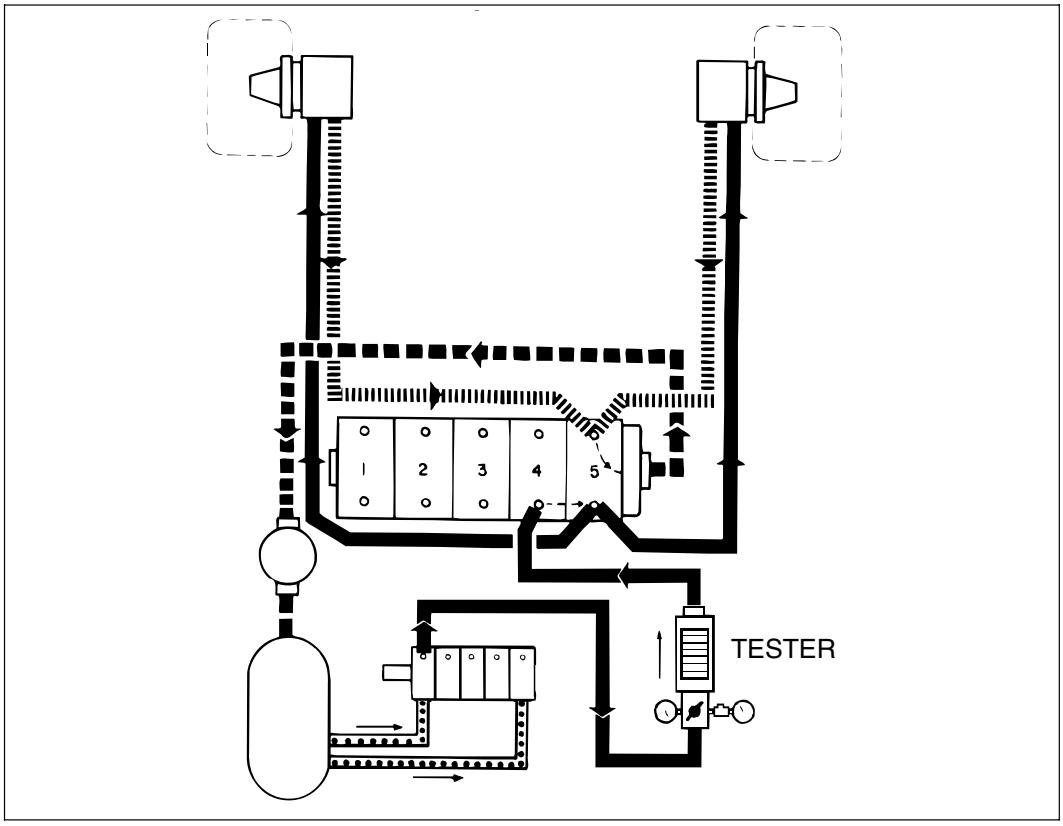
Traction Pump Flow
Traction Relief Setting

TESTER CONNECTION:

Tester in series between traction pump outlet line and valve bank port on No. 4 section of valve bank.

(Tester Flow Control Valve Open)

CAUTION: Keep everyone away from the front of the machine during traction system tests. Operator must be on seat or the safety interlock will stop the engine when the traction lever is engaged.



<u>TEST A:</u> TRACTION PUMP FLOW

PROCEDURE

Traction lever in neutral.

Engine RPM 2800 RPM.

Hydraulic oil at operating temperature.

While watching flow and pressure gauges, slowly close flow control valve until 1000 PSI is obtained.

TESTER READINGS

Flow not lower than 5 GPM at 1000 PSI.

Record pressure and flow readings.

If flow is lower than 5 GPM or a pressure of 1000 PSI cannot be obtained, check for restriction in pump intake line. If not restricted, remove pump and repair as necessary.

TEST HOOK UP NO. 1 *(continued)*

TEST B: RELIEF VALVE SETTING

PROCEDURE

Tester flow control valve open.

Block up traction wheels off floor.

Apply brakes and engage park lock.

Engine RPM 2800.

Hydraulic oil at normal operating temperature.

Engage transmission lever to No. 1 position.

Push traction pedal to forward position.

TESTER READINGS

Pressure: 1850 to 1950 PSI.

If pressure is not in listed range, remove traction relief cartridge and examine for contamination or damage.

TEST HOOK UP NO.2

Traction Motors Mechanical Drag
Valve Bank Leakage
Traction Motors Efficiency

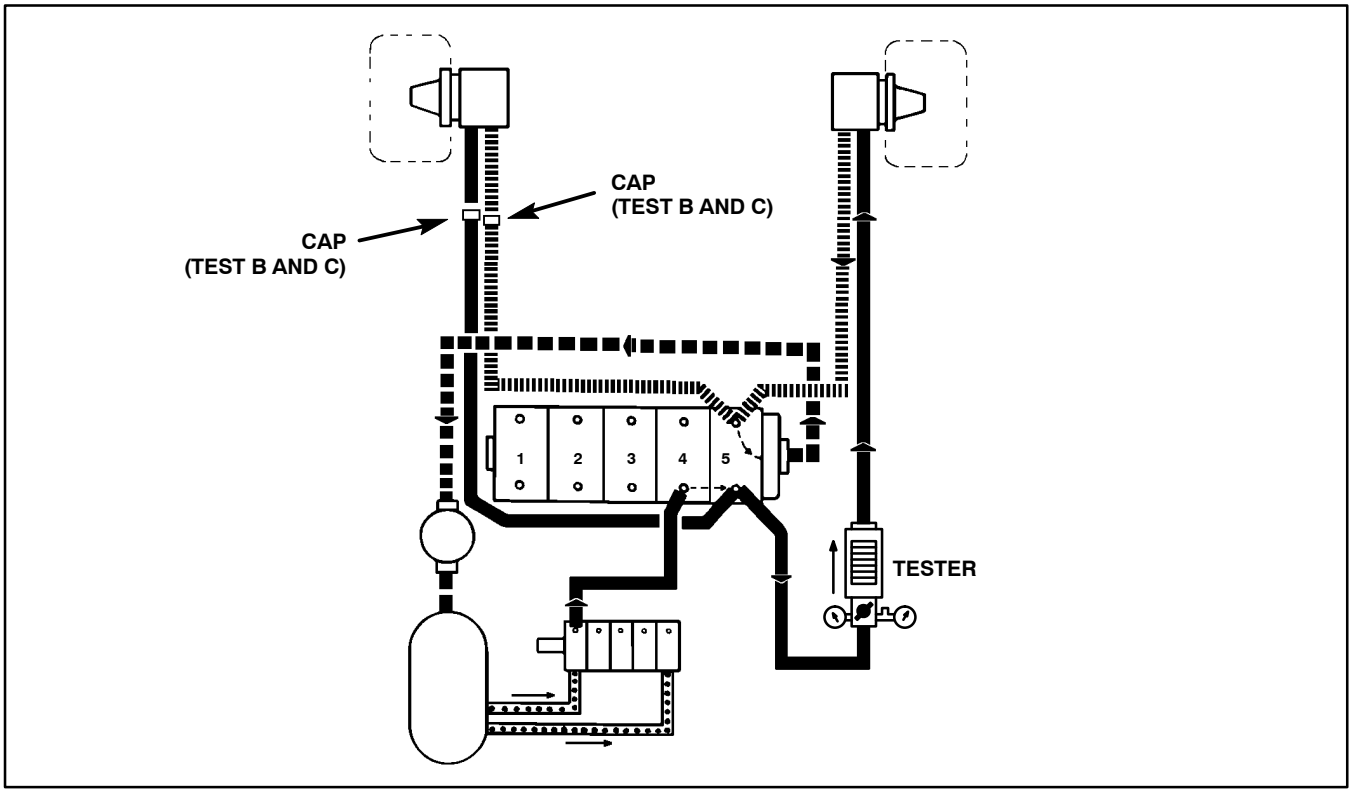
TESTER CONNECTION:

Disconnect hydraulic hose that leads to front right wheel motor from T fitting on rear outlet port of valve bank section No. 5. Connect tester in series between fitting and disconnected hose.

(Tester Flow Control Valve Open)

Note: On machines that have a “U” tube between the elbow fitting on rear outlet port of valve bank section No. 5 and hydraulic tube leading to front wheel motors, remove “U” tube and install tester in series between the two exposed fittings.

CAUTION: Keep everyone away from the front of the machine during traction system tests. Operator must be on seat or the safety interlock will stop the engine when the traction lever is engaged.



<u>TEST A:</u> TRACTION MOTORS MECHANICAL DRAG

PROCEDURE

Block up the machine so traction wheels are off floor. If machine is equipped with 3WD, rear wheel needs to be off floor as well.

Disconnect brake control rod on wheel being tested.

Apply brake and engage park lock.

Engine RPM 2800.

Hydraulic oil at normal operating temperature.

Engage transmission lever to No. 1 position.

Push traction pedal to forward position. Front wheel that is NOT locked by brake should rotate.

TEST HOOK UP NO.2 (continued)

TESTER READINGS

Pressure should not exceed 400 PSI.

If higher reading is obtained, check hydraulic line to and from motor for restriction. If no restriction, remove wheel and brake drum. Repeat test.

If pressure is still excessive, remove traction motor and repair as necessary.

Repeat the test for the opposite wheel if required.

NOTE: Reconnect brake control rod after each test is completed.

TEST B: VALVE BANK LEAKAGE

PROCEDURE

Disconnect both hydraulic hoses that lead to left front wheel motor from hydraulic tubes on left side of machine. Cap open ends of tubes and hoses.

Block up the machine so traction wheels are off floor. If machine is equipped with 3WD, rear wheel needs to be off floor as well.

Disconnect brake control rod on front right wheel.

Engine RPM 2800.

Hydraulic oil at normal operating temperature.

Engage transmission lever to No. 1 position.

Push traction pedal to forward position. Front right wheel should rotate.

While watching flow and pressure gauges, slowly close flow control valve until 1000 PSI is obtained.

TESTER READINGS

Flow not less than 5 GPM at minimum 1000 PSI.

If flow is lower than 5 GPM or pressure of 1000 PSI cannot be obtained, there is internal valve bank leakage. Check:

1. Relief valve
2. No. 4 spool position
3. Disc seal between No. 3 and No. 4 valve bank sections

TEST C: TRACTION MOTOR EFFICIENCY

PROCEDURE

Tester Flow Control Valve Open.

Disconnect hydraulic hoses (pressure and return) that lead to front left motor. Install caps to open ends of tubes and hoses.

Block up the machine so traction wheels are off floor. If machine is equipped with 3WD, rear wheel needs to be off floor as well.

Apply brake and engage park lock.

Engine RPM 2800.

Hydraulic oil at normal operating temperature.

Engage transmission lever to No. 1 position.

Push traction pedal to forward position.

TESTER READINGS

Flow not more than 1.5 GPM at a pressure of 1850 to 1950 PSI.

If flow is higher than 1.5 GPM, remove right wheel motor and repair as necessary.

If pressure is not in listed range, remove traction relief cartridge from valve bank and examine for contamination or damage.

If needed, test left front wheel motor by placing tester in left side pressure hose and blocking flow to right motor.

TEST HOOK UP NO. 3

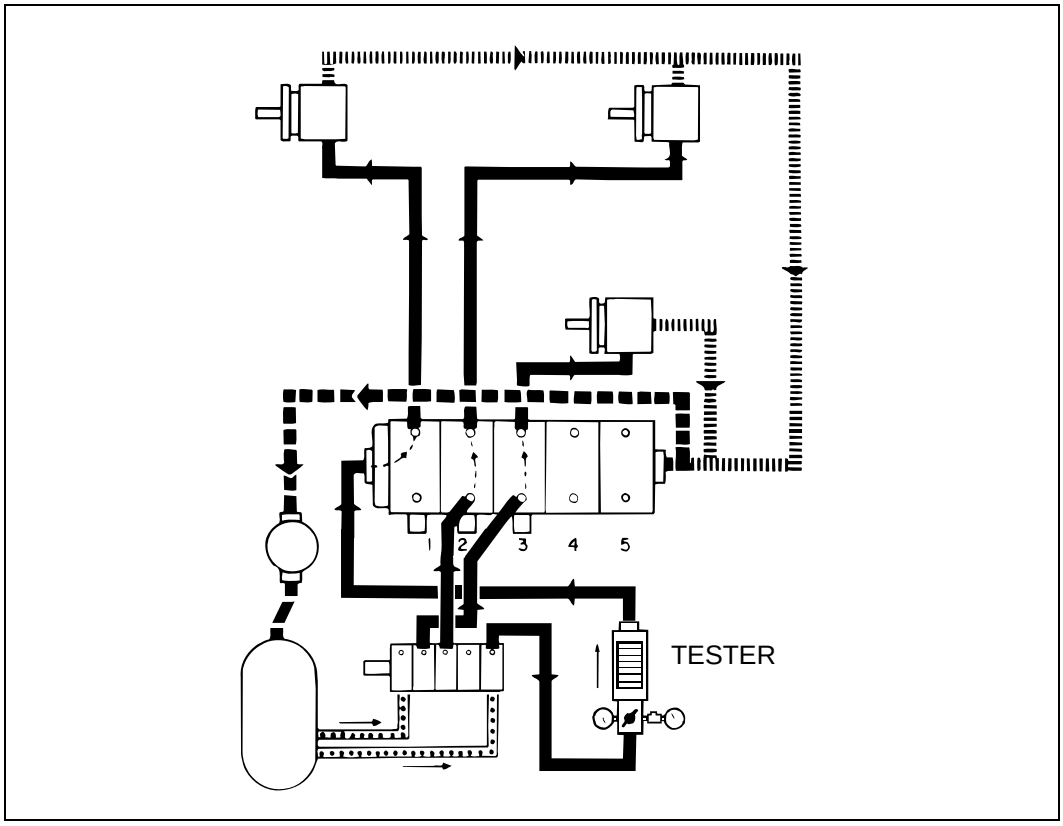
Reel Drive Pump Efficiency

TESTER CONNECTION:

Tester in series between reel pump outlet hose on suspected bad section and its valve bank fitting. Section being checked should be one that supplies oil for reel unit not operating properly.

(Tester Flow Control Open)

CAUTION: Keep everyone away from the front of the machine during reel system tests. Operator must be on seat or the safety interlock will stop the engine when the mow pedal is engaged.



GR3100 WITH DANFOSS PUMP SHOWN.

MACHINES WITH PARKER PUMP USE CENTER 3 PUMP SECTIONS FOR REEL DRIVE CIRCUITS.

<u>TEST A:</u> REEL DRIVE PUMP EFFICIENCY

PROCEDURE

Traction lever in neutral position.

Engine RPM 2800.

Hydraulic oil at operating temperature.

While watching pressure gauges, slowly close flow control valve until 1000 PSI is obtained. Read flow gauge.

TESTER READINGS

Flow not less than 2.5 GPM at 1000 PSI.

If unable to get 1000 PSI or flow is below 2.5 GPM, check for restriction in intake line to reel drive pump. If not restricted, remove pump and repair as necessary.

TEST HOOK UP NO. 4

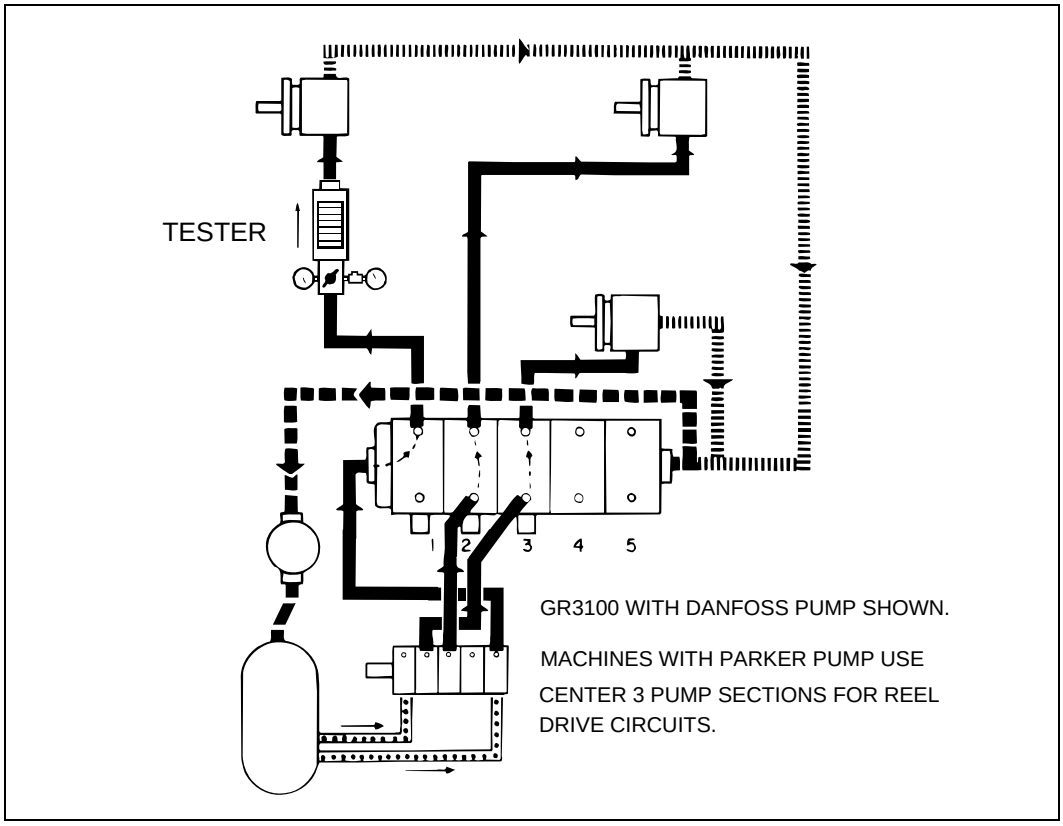
Reel Drive Motor Flow
Reel Drive Relief Setting
Reel Motor Efficiency

TESTER CONNECTION:

Tester in series between pressure hose and motor fitting on suspected bad motor.

(Tester Flow Control Valve Open)

CAUTION: Keep everyone away from the front of the machine during reel system tests. Operator must be on seat or the safety interlock will stop the engine when the mow pedal is engaged.



TEST A: REEL DRIVE MOTOR FLOW

PROCEDURE

Engine RPM 2800.

Mow pedal engaged.

While watching pressure gauges, slowly close flow control valve until 1000 PSI is obtained. Read flow gauge.

TESTER READINGS

Flow not less than 2.5 GPM at 1000 PSI.

If unable to get 1000 PSI or flow is below 2.5 GPM, check rearward spool travel. If spool position is good, remove relief cartridge and examine for contamination or wear.

TEST HOOK UP NO. 4 *(continued)*

TEST B: REEL DRIVE RELIEF SETTING AND REEL MOTOR EFFICIENCY

PROCEDURE

With engine off, insert a block of wood between cutting unit reel blades and front cross tube to prevent reel from turning.

Engine RPM 2800.

Hydraulic oil at operating temperature.

Engage mow pedal.

TESTER READINGS

Flow not more than 0.5 GPM at 2000 to 2100 PSI.

If flow is above 0.5 GPM, remove motor and repair as necessary.

If pressure is is not in listed range, remove relief valve controlling reel being checked and examine for wear or contamination.

TEST HOOK UP NO. 5 (Greensmaster 3100)

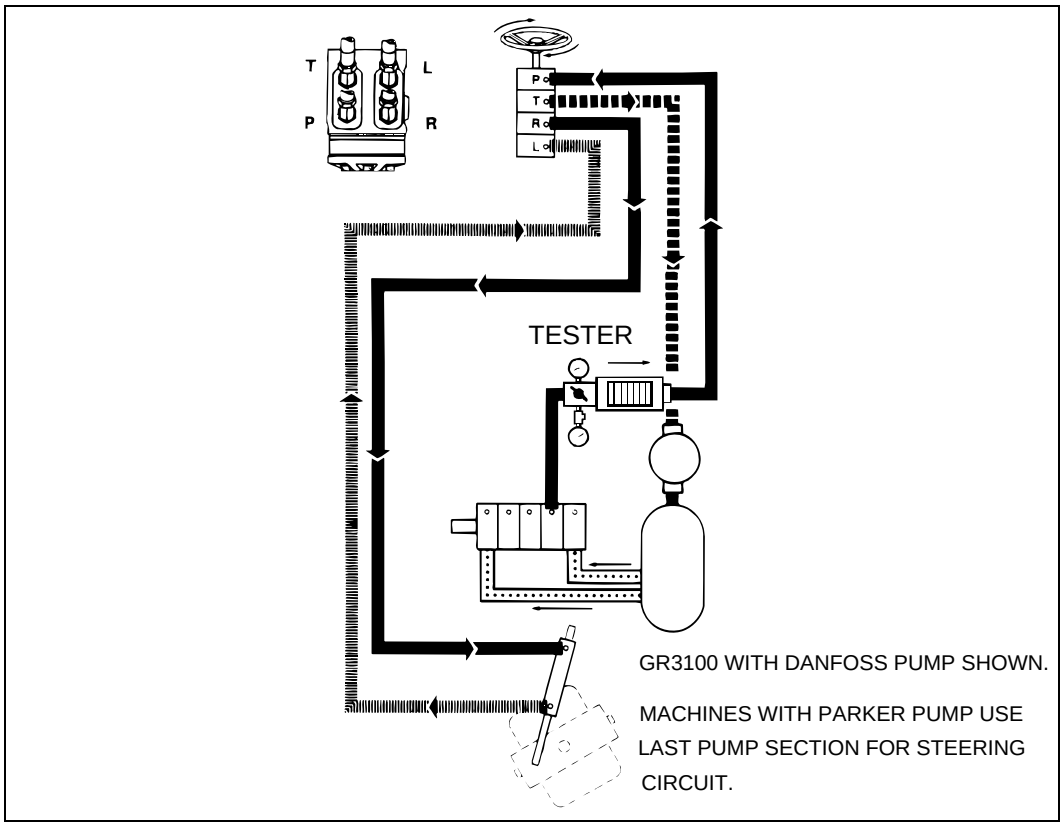
Steering Pump Flow and Relief Pressure

TESTER CONNECTION:

Tester in series between steering pump outlet line and fitting on P (pressure) port of steering control unit.

(Tester Flow Control Valve Open)

CAUTION: Keep everyone away from the front of the machine during steering system tests.



<u>TEST A:</u> STEERING PUMP FLOW

PROCEDURE

Traction Lever in neutral.

Engine RPM 2800.

Hydraulic oil at operating temperature.

While watching flow and pressure gauges, slowly close flow control valve until 600 PSI is obtained.

TESTER READINGS

Flow not lower than 1.5 GPM at 750 to 850 PSI

If flow is less than 1.5 GPM, check for restriction in pump intake line. If not restricted, remove pump and repair as necessary.

If pressure not within listed range, remove steering relief cartridge and examine for contamination or damage. Adjust steering relief valve if necessary.

Adjustments

Lift and Mow Pedal Height Adjustment (Fig. 13)

Adjust the lift and mow pedal to equal height to gain proper spool travel in the valve bank as follows:

1. Put 1, 2 and 3 spools in neutral (center of travel) and remove transfer rod guard from foot panel.

2. Loosen jam nut securing yoke on front of long control rod, remove cotter pin and clevis pin.

3. Move adjustment lever by hand to level the mow and lift pedals and adjust yoke on control rod until hole in yoke lines up with the adjustment lever hole.

4. Install the clevis pin and cotter pin. tighten the jam nut and install the transfer rod guard.

5. Actuate the mow pedal by hand. Be sure the lift pivot under the pedals clears the stop welded to the frame, thereby allowing full spool travel.

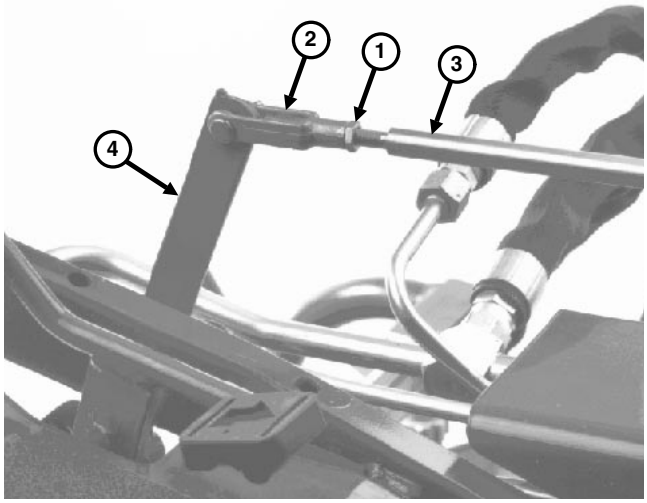


Figure 13

1. Jam nut
2. Yoke
3. Control rod
4. Adjustment lever

Traction Pedal Adjustment (Fig. 14)

To check forward and reverse operation of traction pedal use the following procedure:

Reverse

1. Push down on rear of traction pedal (reverse) until No. 5 section spool valve is completely pushed in.

2. Check distance between bottom of pedal and footrest. Distance should be approximately 3/16 in. If distance is greater or less than 3/16 in. dimension, an adjustment to the traction control rod is required.

3. Remove jamnut and balljoint securing control rod to traction shaft pivot.

4. Loosen jamnuts securing balljoints to control rod and adjust balljoints and control rod to get 3/16 in..

Forward

1. Push the traction pedal fully forward until No. 5 section valve spool is completely pulled out.

2. Pedal should contact pedal stop. If pedal contacts stop before spool is completely out, or if pedal does not make contact with stop, an adjustment to the stop is necessary.

3. Loosen hex nut securing threaded rod to frame. Turn flange nut on rod to raise or lower stop (rod), while checking pedal.

4. When completed, retighten nut.

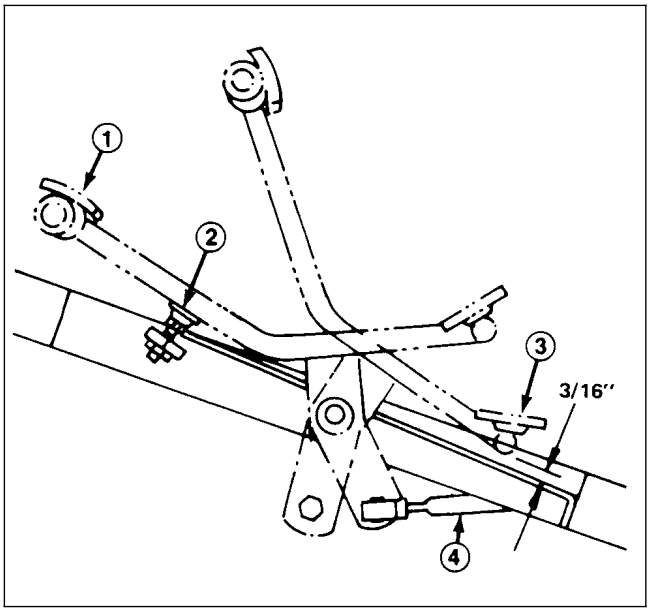


Figure 14

1. Fully forward
2. Pedal stop
3. Reverse
4. Control rod

Traction Return Linkage (Fig. 14a)

If shift selector does not return to Neutral or No. 1 position from No. 2 position when mow pedal is engaged, an adjustment to the traction return linkage is required.

1. Loosen front jam nut securing cable assembly to mow/lift control rod bracket.

2. Move shift lever to No. 1 position.

3. While holding mow/lift control rod in rear position, tighten rear locknut to remove almost all slack from cable assembly. Do not over-tension cable.

4. Tighten front jam nut ot lock adjustment.

5. Check operation and adjust again as necessary.

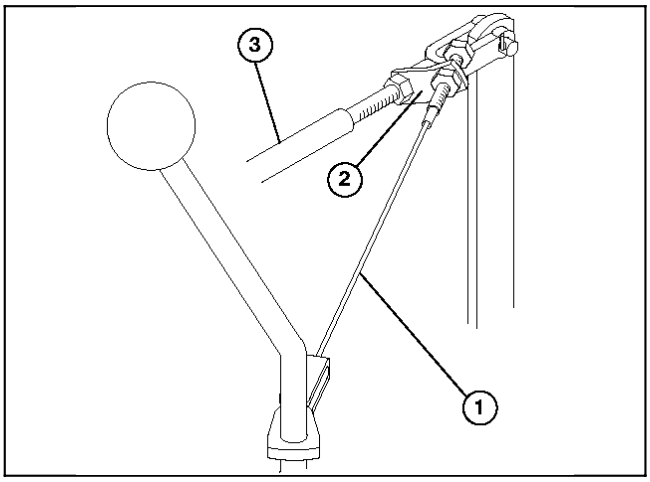


Figure 14a

1. Cable assembly
2. Mow/lift control rod bracket
3. Mow/lift control rod

Rear Camshaft Adjustment (Fig. 15)

A camshaft misaligned with the valve bank may cause the following:

A. No increase in ground speed in No. 2 (transport) traction selection.

B. Mow pedal will not stay depressed (in detent) without foot pressure.

C. Slow lift of the cutting units.

D. Slow or no drive to the cutting units.

If one or more malfunctions occur, loosen the rear camshaft mounting capscrews and relocate the camshaft until the condition is corrected.

Retighten the capscrews.

CAUTION

You must readjust the mow-lift switch when the camshaft adjustment is completed. (See Mow-Lift Switch Adjustment in the Adjustments section of Chapter 5 - Electrical System). The lift and mow pedal height must also be adjusted. (See Lift and Mow Pedal Height Adjustment in this section.)

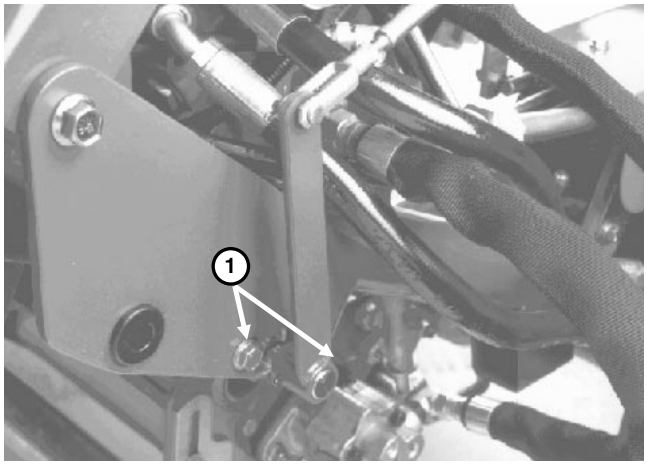


Figure 15

1. Mounting capscrews

Reel Motor Removal and Installation (Fig. 16)

1. Disconnect hydraulic lines. Put caps or plugs on fittings and hoses to prevent contamination. Tag hydraulic lines for proper reassembly.

2. Loosen motor mount nuts.

3. Rotate motor clockwise so motor flanges clear studs and pull motor out.

4. Reverse steps 1 - 3 to reinstall motor.

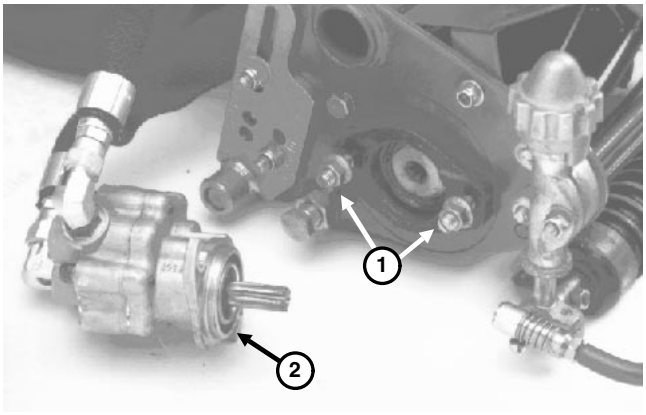


Figure 16

1. Motor mount nuts **2. Motor**

Reel Motor Shaft Seal Replacement (Fig. 17)

1. Disconnect and reverse hydraulic lines on affected motor (connect pressure line to outlet fitting on motor and return line to inlet fitting on motor).

IMPORTANT: Make sure hydraulic lines are connected properly after shaft seal is replaced.

2. Loosen motor mount nuts.

3. Rotate motor clockwise so motor flanges clear studs and pull motor out.

4. Remove snap ring from motor.

5. Start the engine. DO NOT engage the mow pedal. Back pressure in the hydraulic system will push shaft seal out of motor. Stop the engine.

NOTE: Seal may also be removed by punching two holes in face of seal 180^{o} apart, installing metal screws and pulling seal out by grasping the screws.

6. Disconnect hydraulic lines from motor.

7. Remove and discard shaft seal and spacer.

8. Install a new spacer on motor shaft.

9. Put seal protector on motor shaft or apply tape on the shaft. Be careful to prevent the shaft spline from damaging the new seal.

10. Apply “Loctite 515 Gasket Eliminator” or equivalent to outside diameter of new seal.

11. Apply generous amount grease to inside diameter of new shaft seal.

12. Use seal installation tool to install new shaft seal. Make sure seal is installed square with the seal bore.

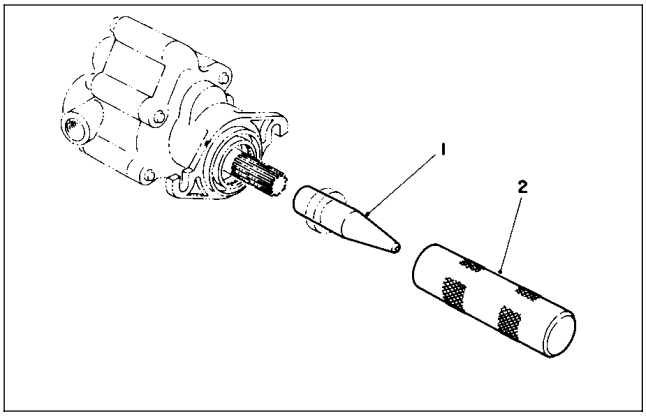


Figure 17

1. Seal protector
2. Seal installation tool

Reel Motor 70-9800 Repair (Fig. 18)

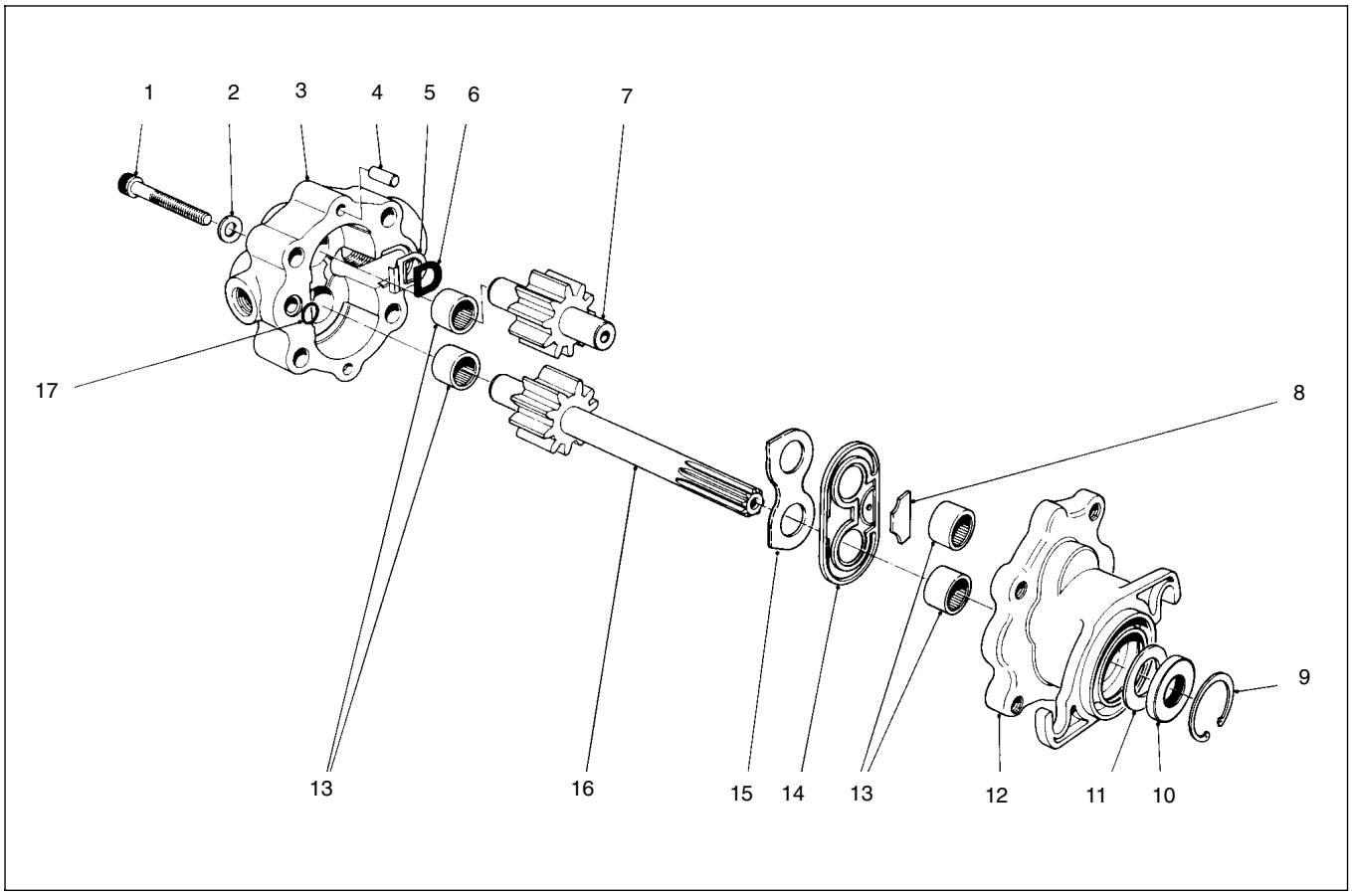


Figure 18

1. Plug ports and wash exterior of motor with mineral spirits or solvent. Make sure parts and work area are clean.

IMPORTANT: Extreme caution must be used when using a vise to avoid distorting any parts.

2. Draw a line across the seam areas on the motor case with a scribe or marker to ensure proper reassembly.

3. Remove four socket head capscrews.

4. Put your hand on the cover assembly and gently tap the drive shaft with a soft face hammer to separate the body from the cover. Be careful not to drop parts or disengage gear mesh.

5. Before removing gear set, apply marking dye to mating teeth to retain “timing” when reassembling.

6. Be careful when disassembling. The needle bearings may be of the loose grease retained type. Pack these with general purpose grease to retain them for reassembly. It is recommended NOT to remove the bearing races from the cover and body.

7. Remove and discard the bridging insert, gasket insert, anti-extrusion block, snap ring, shaft seal, spacer, seal assembly, wear plate and o-ring, (Items 5, 6, 8-11, 14, 15 and 17). These items are available in a repair kit.

8. Clean all parts and check for burrs, scoring, nicks, etc.

9. Rub mating surfaces of body and cover with 400 grit or finer sandpaper to remove any Loctite residue. Wash body and cover to remove abrasive material.

10. Apply grease to bridging insert and put in cover, tab side down.

11. Apply grease to gasket insert and put in place over bridging insert.

12. Stone gears if wear plate appears scored. Replace as set if necessary. Oil the inside of cover and insert the gear set, maintaining the original timing and locations.

13. Apply grease to wear plate and slip over shafts with wider cross section next to bridging insert. If the wear plate is made of steel backed bronze, the bronze side must face gears.

14. Apply grease to anti-extrusion block and put in recess of seal assembly, with ground face showing.

15. Apply grease to seal assembly and put in body counterbore. Anti-extrusion block must face body on the tank port side when the motor is assembled (same side as bridging insert).

16. Mating surfaces of body and cover must be clean, free of oil and dry. Clean both surfaces with “Locquick” primer or clean shop solvent. Spread a thin, even coating of “Loctite 515 Gasket Eliminator” or equivalent on one surface.

17. Assemble the body to the cover, making sure that none of the parts become displaced. Insert the capscrews and washers and hand tighten.

18. Before tightening the capscrews, rotate the drive shaft in the direction of normal rotation (counterclockwise) to check for binding. You may not be able to rotate the drive shaft by hand. Protect the shaft if using a pliers.

19. Tighten the capscrews evenly in a crossing pattern to a torque of 190-210 in-lb.

20. Carefully install a new spacer, shaft seal and snap ring. (Perform steps 8 - 12 under Reel Motor Shaft Seal Replacement in this section of the book).

21. Allow 60 minutes for liquid gasket material to harden before operating motor.

Reel Motor 94–3506 Repair (Fig. 18a)

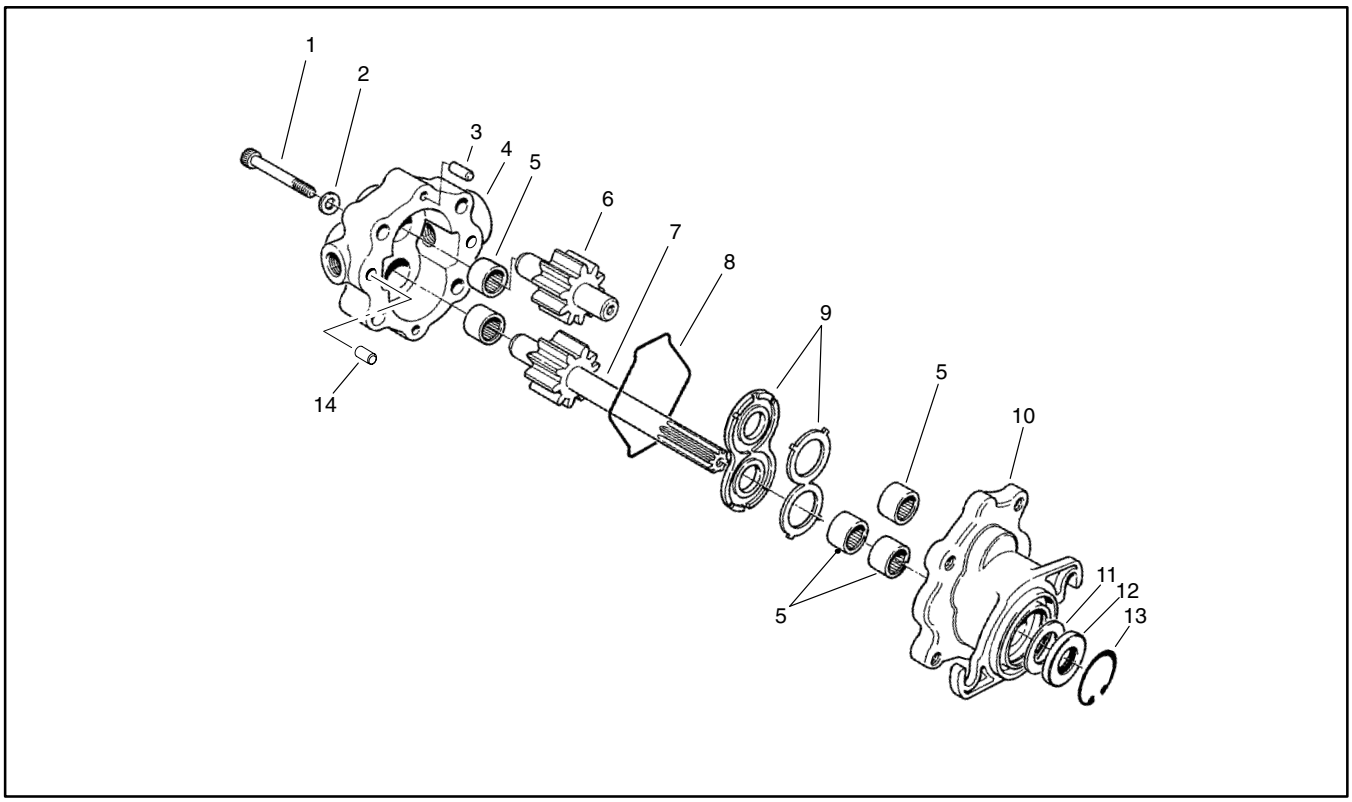


Figure 18a

1. Plug ports and wash exterior of motor with mineral spirits or solvent. Make sure parts and work area are clean.

IMPORTANT: Extreme caution must be used when using a vise to avoid distorting any parts.

2. Draw a line across the seam areas on the motor case with a scribe or marker to ensure proper reassembly.

3. Remove four socket head capscrews (1) and washers (2).

4. Put your hand on the cover assembly (4) and gently tap the drive shaft with a soft face hammer to separate the body (10) from the cover. Be careful not to drop parts or disengage gear mesh.

5. Before removing gear set, apply marking dye to mating teeth to retain “timing” when reassembling. Motor efficiency may be affected if the teeth are not installed in the same position during reassembly.

IMPORTANT: To prevent damage to load plate or cover during motor operation, do not mark gears with a punch or scribe.

6. Be careful when disassembling. The needle bearings (5) may be of the loose grease retained type. Pack these with general purpose grease to retain them for re–asembly. It is recommended NOT to remove the bearing races from the cover and body.

7. Remove the load plate assembly (9).

8. Remove and discard the seal ring (8), snap ring (13), shaft seal (12), and spacer (11). These items are available in a repair kit.

9. Clean and air dry all parts. Check for burrs, scoring, nicks, etc.

10. Replace gears as set if excessively scored or worn. Replace load plate if worn or scored.

11. Apply grease or petroleum jelly to load plate assembly (9) and install in body.

12. Dip gears in oil and install in body, maintaining original timing and locations.

13. Apply grease or petroleum jelly to ring seal (8) and install in body.

14. Apply hydraulic oil to inside of cover (4) and assemble cover to body, making sure that none of the parts become displaced. Insert the cap screws and washers and hand tighten.

15. Before tightening the capscrews, rotate the drive shaft in the direction of normal rotation (counterclock–wise) to check for binding. You may not be able to rotate the drive shaft by hand. Protect the shaft if using a pliers.

16. Tighten the capscrews evenly in a crossing pattern to a torque of 17 ft–lb.

17. Carefully install a new spacer, shaft seal and snap ring. (Perform steps 8 – 12 under Reel Motor Shaft Seal Replacement in this section of the book).

Reel Motor 105–9770 Repair (Fig. 18b)

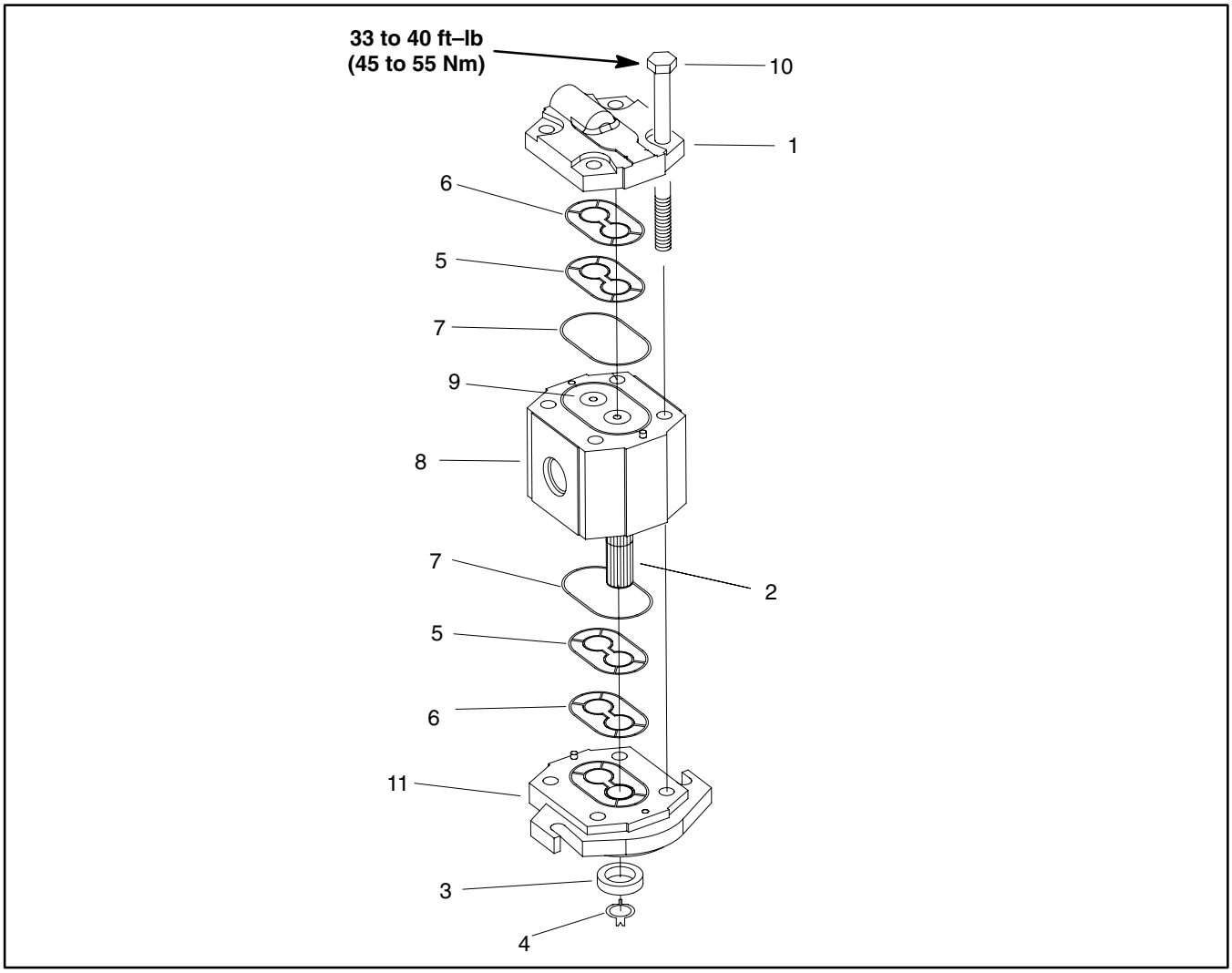


Figure 18b

1. **Rear cover**
2. **Drive gear**
3. **Seal**
4. **Tab washer**
5. **Pressure seal**
6. **Back–up ring**
7. **O–ring**
8. **Body**
9. **Idler gear**
10. **Cap screw**
11. **Front flange**

Disassembly

1. Plug motor ports and clean the outside of the motor thoroughly. After cleaning, remove plugs and drain any oil out of the motor.

2. Use a marker or scribe to make a **diagonal** mark across the front flange, body, and rear cover for reassembly purposes (Fig.18c).

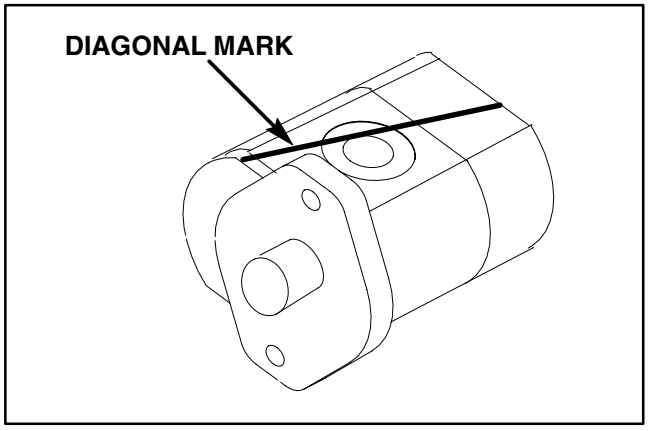


Figure 18c

IMPORTANT: Avoid using excessive clamping pressure on the motor flange to prevent distorting the casting.

3. Clamp mounting flange of motor in a vise with the shaft end down.

4. Loosen cap screws on the rear cover.

5. Take motor from the vise and remove cap screws.

6. Remove front flange from the body, then remove rear cover. Locate and remove dowel pins from body.

IMPORTANT: Mark the relative positions of the gear teeth and the bearing blocks so they can be re-assembled in the same position. Do not touch the gear surfaces as residue on hands may be corrosive to gear finish.

7. Place the motor on its side and push on the rear bearing block to remove the bearing block and gear set (Fig. 18d).

8. Carefully remove and discard o–rings, pressure seals, and back–up rings (Fig. 18e) from motor. Do not cause any damage to the machined grooves during the removal process.

IMPORTANT: Make sure not to damage the counter bore when removing the shaft seal from the front plate.

9. Position front flange with seal side up. Remove shaft seal.

Inspection

1. Remove any nicks and burrs from all motor components with emery cloth.

CAUTION

Use eye protection such as goggles when using compressed air.

2. Clean all motor components with solvent. Dry all parts with compressed air.

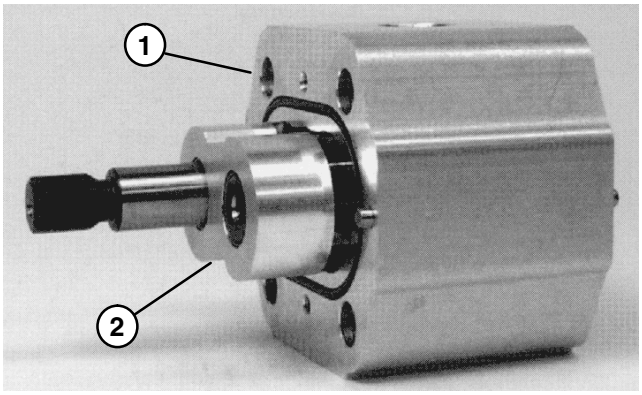


Figure 18d

1. **Motor body**
2. **Bearing block & gear set**

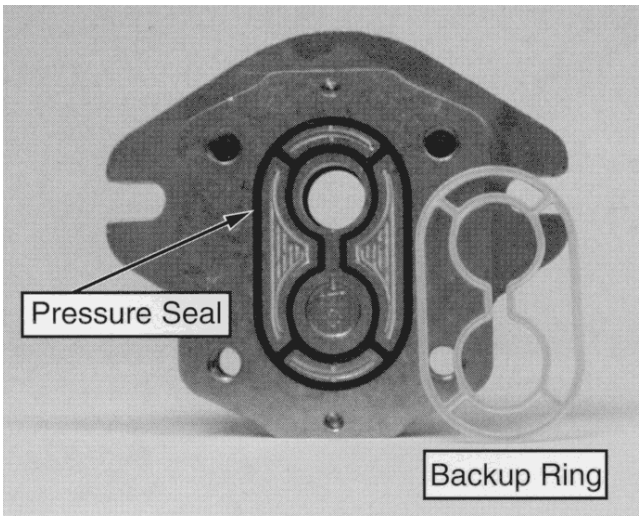


Figure 18e

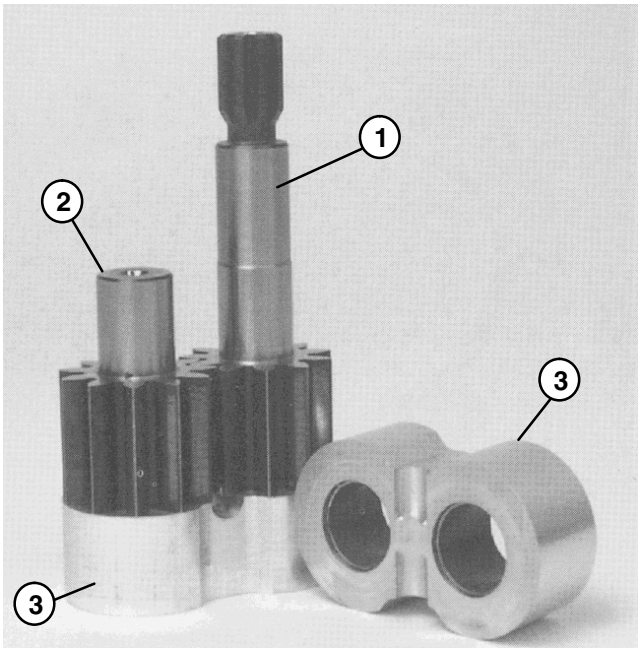


Figure 18f

1. **Drive gear**
2. **Idler gear**
3. **Bearing block**

3. Inspect drive gear, idler gear and bearing blocks (Fig. 18f) for the following:

A. Gear shafts should be free of rough surfaces and excessive wear at bushing points and sealing areas. Scoring, rough surfaces, or wear on gear shafts indicates need for replacement.

B. Gear teeth should be free of excessive scoring and wear. Any broken or nicked gear teeth must be replaced.

C. Inspect gear face edge for sharpness. Sharp edges of gears will mill into bearing blocks and, thus, must be replaced.

D. Bearing areas of bearing blocks should not have excessive wear or scoring.

E. Face of bearing blocks that are in contact with gears should be free of wear, roughness or scoring.

4. Inspect front flange and rear cover for damage or wear.

Reassembly

NOTE: When reassembling the motor, check the identification marks made during disassembly to make sure the parts are properly aligned during reassembly.

1. Lubricate o–rings, pressure seals, back–up gaskets, and seal grooves with a thin coat of petroleum jelly. Lubricate all other internal parts freely with clean hydraulic oil.

2. Install new shaft seal into front flange.

3. Install lubricated pressure seals into the grooves in the front flange and rear cover. Follow by carefully placing the back–up rings into the grooves.

4. Install new o–rings to the body.

5. Lubricate gear faces and bearing surfaces of drive gear, idler gear, and bearing blocks. Carefully assemble bearing blocks and gears noting identification marks made during disassembly.

6. Position the motor body on its side. Carefully slide bearing block and gear assembly into the body cavity using identification marks made during disassembly.

7. Remove any excess lubrication from mating surfaces of body, rear cover, and front flange. Make sure that these surfaces are clean and dry.

8. Install dowel pins in body.

IMPORTANT: Do not dislodge o–rings, pressure seals, or back–up rings during final assembly.

9. Gently slide the rear cover onto the assembly using marker or scribe mark for proper location. Firm hand pressure should be sufficient to engage the dowel pins.

10. Position the motor with rear cover downwards. Carefully slide the front flange onto the assembly using marker or scribe mark for proper location.

11. Install the four cap screws and hand tighten.

IMPORTANT: Avoid using excessive clamping pressure on the motor housing to prevent distorting the housing.

12. Place motor front flange in a vise and alternately torque the cap screws from 33 to 40 ft–lb (45 to 55 N–m).

13. Put a small amount of hydraulic oil in port on motor and rotate driveshaft one revolution. Protect the shaft if using a pliers. If drive shaft binds, disassemble motor and repeat assembly process.

14. Remove motor from vise.

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Hydraulic Pump Removal and Installation - Greensmaster 3100 shown (Fig. 19)

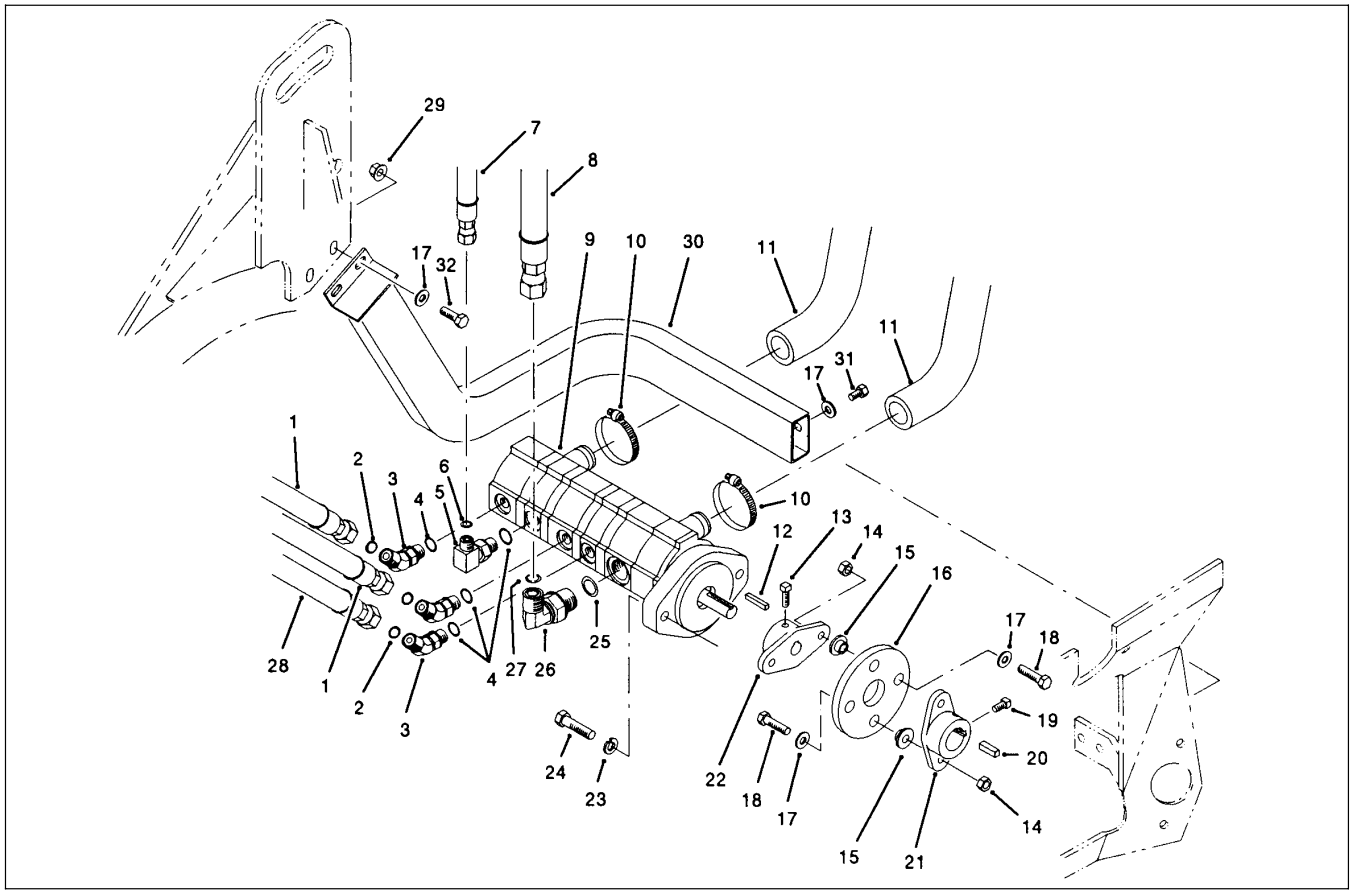


Figure 19

Disassembly

1. Drain the hydraulic reservoir.

2. Remove the hydraulic lines from the pump (Fig. 9). Put plugs in the pump ports. Put covers on the fittings.

IMPORTANT: When disassembling hydraulic lines make sure hydraulic plugs are placed in the open end of the hydraulic line to prevent debris from contaminating hydraulic fluid. It is also a good idea to tag hydraulic lines when disassembling so that they can be properly reassembled. Keep all hydraulic and suction lines clean and free from debris. During replacement avoid overtightening fittings (see the Hydraulic Hose and Fitting Information section of this chapter). Check hydraulic lines for breaks or cracks. Check the hydraulic reservoir for proper fluid level after replacement of any large component.

3. Loosen the set screws (Item 13) securing the pump hub (Item 22) to the shaft, remove the capscrews (Item 24) mounting the pump to the pump mount and remove the pump.

Reassembly

1. Fill pump with clean hydraulic fluid and cap fittings.

2. Assemble the pump to the engine in reverse of the disassembly procedures. Check all lines for clearance from the frame and other components.

3. Start machine and check for proper performance.

Pump Repair - Greensmaster 3100 shown (Fig. 22)

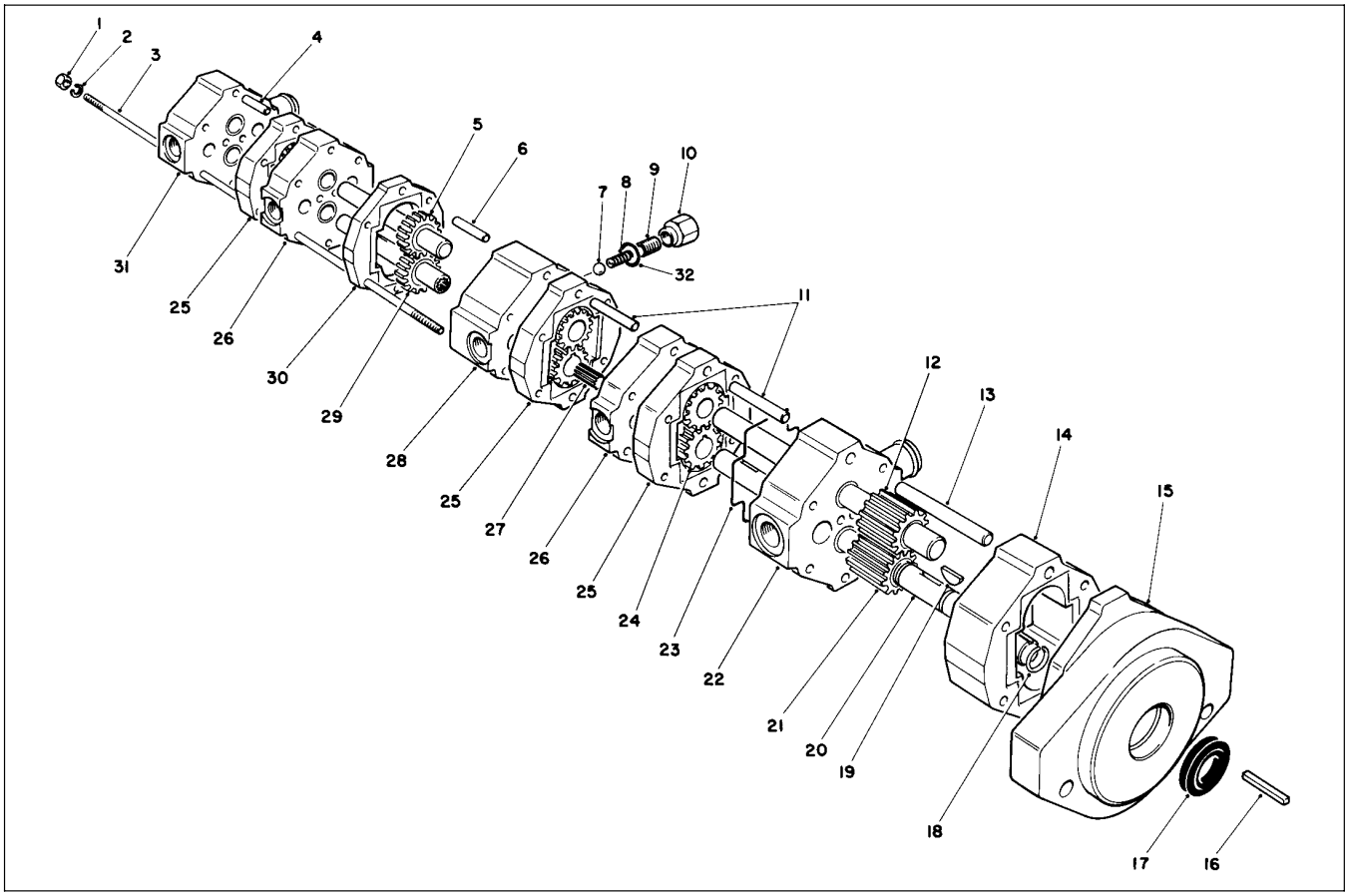


Figure 22

Relief Valve Service

1. Remove cap (Item 10). Remove valve adjuster (Item 9), spring (Item 8), and ball (Item 7).

2. Remove o-ring (Item 32) from cap.

3. Inspect ball for burrs or roughness. Inspect relief valve bore and seat in bearing plate (Item 28).

4. Inspect spring for damage.

5. Clean and dry all parts. Apply hydraulic oil to parts. Install ball, spring and valve adjuster.

6. Install new o-ring on cap and install cap.

7. Before operating the machine, check steering relief pressure and adjust to 800 psi. To adjust, remove cap, turn adjuster clockwise to increase pressure and counterclockwise decrease pressure. (See Test Hook Up No. 5, Steering Pump Flow and Steering Pump Relief Setting in the Testing section of this chapter.)

Pump Service

1. Plug ports and wash exterior of pump with mineral spirits or solvent. Make sure parts and work area are clean.

2. Draw a line across the seam areas on the pump case with a scribe or marker to ensure proper reassembly.

IMPORTANT: Use caution when using a vise to avoid distorting any parts.

3. Secure the flange end of the pump (Item 15) in a vise with the drive shaft (Item 20) pointing down.

4. Remove the four locknuts (Item 1) and lockwashers (Item 2).

5. Put your hand on the pump case and gently tap the pump case with a soft face hammer to loosen the pump sections. Be careful not to drop parts or disengage gear mesh.

6. Before removing each gear set, apply marking dye to mating teeth to retain “timing” when reassembling.

7. Be careful when disassembling. The needle bearings in the body assembly (Item 15) may be of the loose grease retained type. Pack these with general purpose grease to retain them for reassembly. It is recommended NOT to remove the bearing races from the flange assembly.

8. Remove and discard the oil seal and seal rings (Items 17 and 23) as the pump is disassembled.

9. Clean all parts. All parts must be check for burrs, scoring, nicks, etc. Check the bushings in the plate assemblies (Items 22, 26 and 28) and cover assembly (Item 31) for excessive wear or scoring. Replace the assemblies as necessary. The bushings are not serviceable.

10. Stone gears if plate surfaces appear scored. Replace gears as sets if necessary. Oil the inside of gear plates (Items 14, 25 and 30) and insert gear sets, maintaining the original timing and locations.

11. Assemble pump sections starting at the body assembly (Item 15). Install woodruff keys (Item 19) and align keyways in gears as they are installed over the shafts. Apply grease to new seal rings (Item 23) before installing.

12. After pump has been assembled, tighten locknuts by hand. Rotate the drive shaft to check for binding. Protect the shaft if using a pliers.

13. Tighten the locknuts evenly in a crossing pattern to a torque of 17 to 19 ft-lb.

14. Before installing oil seal (Item 17) put seal protector on pump shaft or apply tape on the shaft.

15. Before installing fill volume between lips of new seal with Master Lubricant Co. “Lubrico M-6”, Lubriplate “Aero Lube” or equivalent. Apply grease to inside diameter of new oil seal. Carefully install a new oil seal. Assemble spring loaded lip of seal toward bearing.

Control Valve Removal and Installation (Fig. 23)

1. Remove knob from the shift lever and disassemble the right side panel from the machine.

2. Remove the seat or secure it in an up position, disconnect the wires from the safety switch located on the valve bank and place a drain pan under the valve bank.

3. Disassemble the chain links from all five (5) spools.

4. Tag and identify the lines leading to the valve bank, disconnect and cap the lines and fittings with plastic plugs.

5. Loosen the capscrews securing the valve bank to the frame and remove the valve bank.

NOTE: Shims may be installed between the bank and frame. Note the quantity and mounting location and install in proper location upon reassembly.

6. Reverse steps 1 - 5 to install the valve bank. Do not over-tighten fittings. Use two wrenches to secure flexible line connectors, one wrench to prevent the Line from twisting, the other to tighten the connection. (See the Hydraulic Lines and Fittings section of this chapter.)

7. Check to be sure all lines are routed correctly and are not in contact with one another or other components. It should be possible to slip a strip of paper between any lines and other components in close relationship. Relocate if necessary.

8. Adjust the traction linkage, switches and reel drive camshaft as necessary.

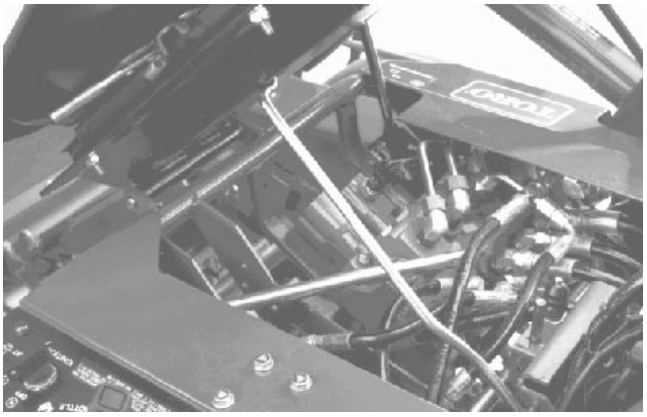


Figure 23

Relief Valve Removal and Installation (Fig. 24)

1. Be careful not to interchange parts, such as springs or shims, between relief valves. The same number and thickness of shims must be installed when reassembling the relief valve.

2. Clean and inspect relief valve parts and the valve section housing. Replace parts as necessary. Install new seals and back-up rings. Apply hydraulic oil to parts before installing.

3. Before operating the machine, check the relief pressure for the affected relief valve. (See the Testing section of this chapter.) Adjust relief valve by adding or removing shims between the spring and poppet.

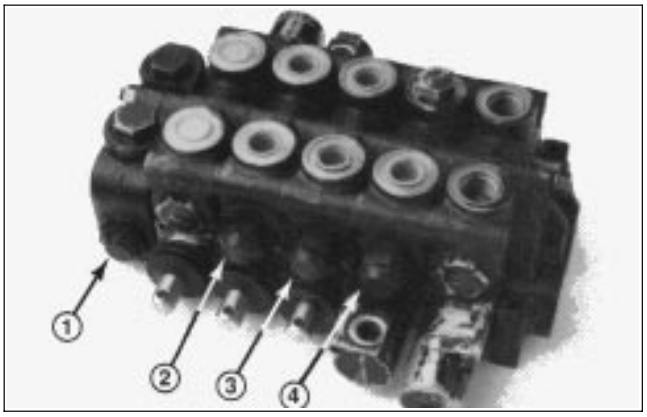


Figure 24

1. Main & No. 1 section relief
2. No. 2 section port relief
3. No. 3 section port relief
4. No. 4 (traction) relief

Control Valve Spool Seal Replacement

IMPORTANT: To prevent leakage, make sure you keep foreign material such as dirt, sand or paint chips out of valve body seal grooves.

NOTE: Except for the seal under No. 4 spool bonnet, the valve bank does not normally have to be removed from the machine to replace spool seals.

Front (Chain Link) Side (Fig. 25)

1. Remove the chain link, boot and breather washer from the spool.

2. Remove the seal retainer, back-up washer and lip seal from the valve body. Clean the seal groove.

3. Soak the new seal in clean hydraulic fluid. INSTALL THE SEAL WITH THE OPEN (LIP) SIDE FACING IN TOWARDS THE VALVE BODY. Install the back-up washer and seal retainer

4. Install the breather washer, boot and chain link. Start the engine and check for leaks.

Rear (Bonnet) Side (Fig. 26)

1. Remove the bonnet.

NOTE: The valve bank must be removed in order to replace the spool seal under the bonnet on No. 4 spool.

2. Disassemble the components attached to the rear of the spool. (See Control Valve No. 1 Spool Detent Replacement and Control Valve No. 4 Spool Detent Replacement in this section of the book.)

NOTE: The assemblies under each spool bonnet are different from one another. Pay close attention to how they are disassembled so they will be reassembled correctly.

3. Remove the seal retainer, back-up washer, and lip seal from the valve body and clean the seal groove.

4. Soak the new seal in clean hydraulic fluid. INSTALL THE SEAL WITH THE OPEN (LIP) SIDE FACING IN TOWARDS THE VALVE BODY. Install the back-up washer, seal retainer and remaining components.

IMPORTANT: Make sure the switch is correctly positioned and adjusted when bonnet is installed on No. 2 or No. 4 spool. (See Mow/Lift Switch Replacement and Adjustment or Traction Switch Replacement and Adjustment in Chapter 6 - Electrical System.)

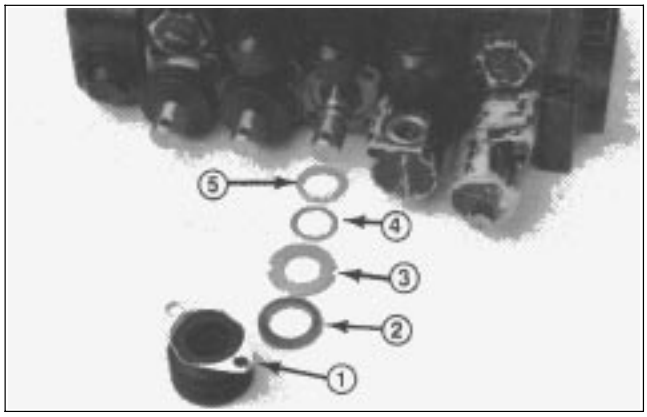


Figure 25

1. Boot
2. Breather washer
3. Seal retainer
4. Back-up washer
5. Lip seal

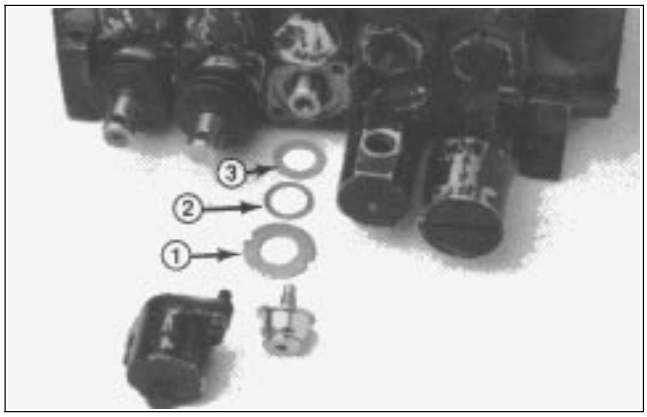


Figure 26

1. Seal retainer
2. Back-up washer
3. Lip seal

Control Valve Internal Seal Replacement (Fig. 27)

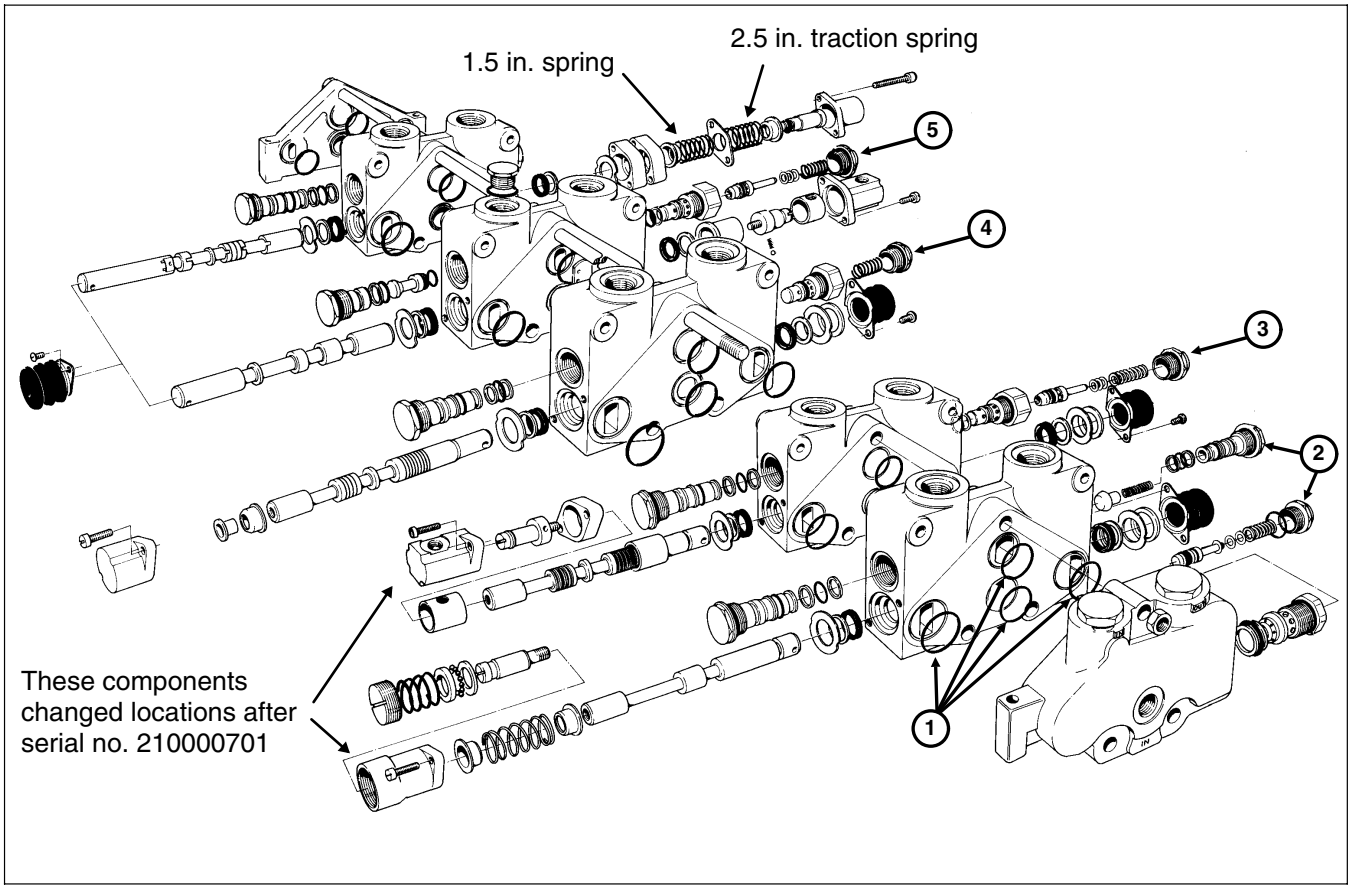


Figure 27

1. Internal seals (4 between ea. sect.)
2. Main & No. 1 section relief valve
3. No. 2 section relief valve
4. No. 3 section relief valve
5. No. 4 (traction) section relief valve

NOTE: Replace all internal seals whenever valve sections are disassembled. Original seals may not seal after the valve assembly is installed on the machine.

1. Remove the valve bank. (See Control Valve Removal and Installation in this section of the book.)

2. Put the valve bank in a vertical position in a bench vise, and remove the locknuts from the three (3) bolts securing the sections together (Fig. 27).

3. Slide each section off the studs. Identify them so they will not be reassembled in the wrong location.

4. Remove all original o-ring seals, clean the o-ring grooves and check the mating surfaces of each section for any imperfections or contaminants which could cause leakage to occur.

5. Soak the replacement o-rings in clean hydraulic fluid and install them into the ring grooves as you stack each section on top of another.

6. Install the locknuts onto the studs and torque them to 15-20 ft-lb (20.4-27.2 Nm).

IMPORTANT: Do not overtorque. This will distort the valve bodies and cause binding of the spools.

7. Install the valve bank onto the machine.

Control Valve No. 1 Spool Detent Replacement (Fig. 28, 29)

NOTE: These procedures can be done with the control valve assembly installed on the machine.

1. Remove the entire detent assembly from the control valve. Keep the backup washer, seal retainer and seal with the spool.

2. Apply Locktite 222 or equivalent to threads of detent stud (Item 9) and assemble into spring and stop collars (Items 6 and 8). Thread the assembly into the No. 1 spool. The spring (Item 6) needs to be compressed to get detent stud started. Anchor the slotted end of the spool and apply 10-14 ft-lb (13.6-19 Nm) torque to detent stud (Item 9).

3. Slip bonnet (Item 1) over the entire assembly and secure it to the valve body with the two capscrews. Be sure slot in mounting face of bonnet is at bottom before installation.

4. Install the thrust plate (Item 5) into the bonnet (Item 1) so it bottoms out. Apply approximately 1/4 in. (6 mm) of #2 multi-purpose Lithium-base grease on top of thick washer (Item 5).

5. Install twelve balls (Item 4) into thrust plate (Item 5).

IMPORTANT: If the detent bonnet contains a vent pocket, do not let the balls fall into the vent.

6. Insert race (Item 3) on top of balls with ramp of race facing inward as shown. Rotate race (Item 3) until you are sure all balls are resting properly against the surfaces of the race and thrust plate (Items 3 and 5).

7. Insert spring (Item 2) into bonnet (Item 1).

8. Apply Locktite 222 or equivalent to the threads of adjustment cap (Item 10) and thread into bonnet. Turn adjustment cap in to compress the spring (Item 2). Actuate the spool assembly, then turn the adjustment cap until the desired detent action is obtained. This will usually be within three turns from bottoming out the adjustment cap..

NOTE: Each turn of adjustment cap (Item 10) changes the “Feel” of the detent action about 20%.

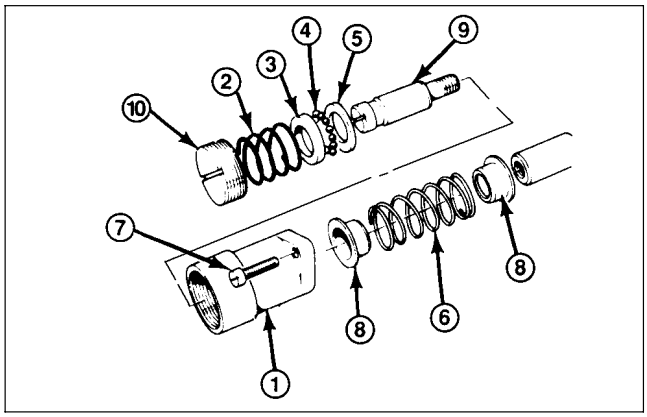


Figure 28

1. Bonnet	**6. Spring**
2. Spring	**7. Capscrew**
3. Race	**8. Stop collars**
4. Ball	**9. Detent stud**
5. Thrust plate	**10. Adjustment cap**

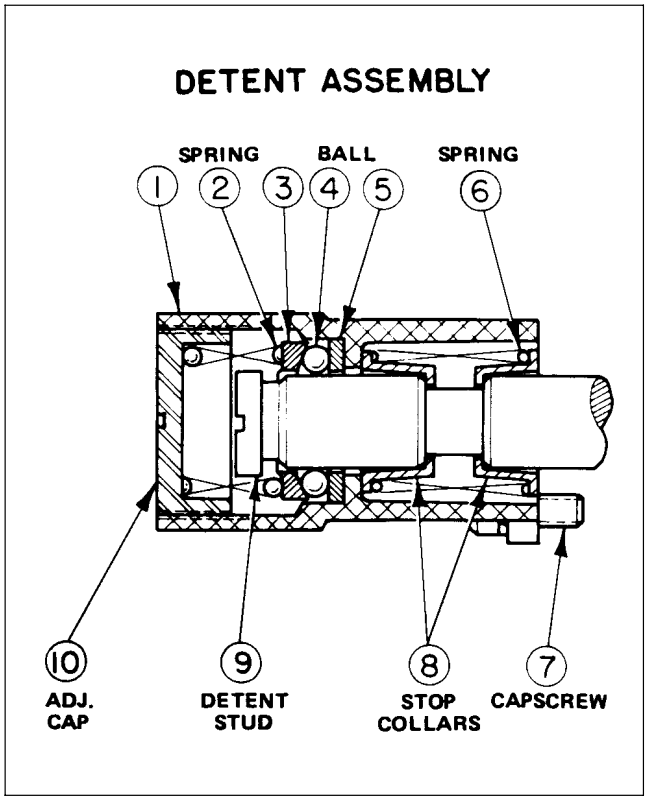


Figure 29

Control Valve No. 4 Spool Detent Replacement (Fig. 30)

NOTE: The control valve assembly must be removed to replace this assembly. (See Control Valve Removal and Installation in this section of the book.)

1. Be sure No. 4 spool is in neutral and remove the bonnet, large spring, and stop collar.

2. Hold one hand in front of detent sleeve and push the front of the spool in very slowly until the detent balls pop out. Be sure to remove all four (4) balls.

3. Push the front of the spool in carefully until the holes in the detent adapter are just past the edge of the detent sleeve.

IMPORTANT: Do not push the spool too far or the rear spool seal may be cut by the spool.

4. Hold the front of the spool from turning, insert a drift punch through the holes in the adapter and rotate the adapter counter-clockwise to remove it from the spool.

5. Remove the detent sleeve.

Reassemble With the Following Procedures:

1. Mount the detent sleeve and the detent adapter. Lock the adapter securely to the spool.

2. Apply a light coat of grease to the adapter holes, insert the small spring, the four balls, and the ball follower.

3. Stand the valve bank assembly up so the front (clevis end) of No. 4 spool is facing downward.

4. Slide the detent sleeve up to the four balls. Apply light pressure against the balls with the sleeve. Push against the center of the ball follower with a drift punch to allow the balls to slip into the adapter holes and the sleeve to slide over the assembly.

IMPORTANT: Do not push spool too far or the rear spool seal may be cut by the spool.

5. Assemble the stop collar, large spring and bonnet to the valve body. Check the spool for proper detent operation and mount the valve bank onto the machine.

6. Adjust the traction switch. (See Traction Switch Removal, Installation and Adjustment in the Repairs section of Chapter 5 - Electrical System.)

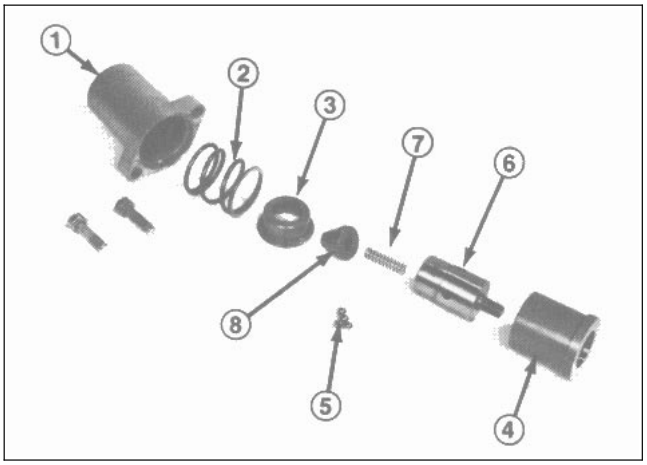


Figure 30

1. Bonnet
2. Spring
3. Stop collar
4. Detent sleeve
5. Balls (4)
6. Detent adapter
7. Spring
8. Ball follower

Lift Cylinder Removal and Installation

No. 1 (Center) Lift Cylinder (Fig. 32)

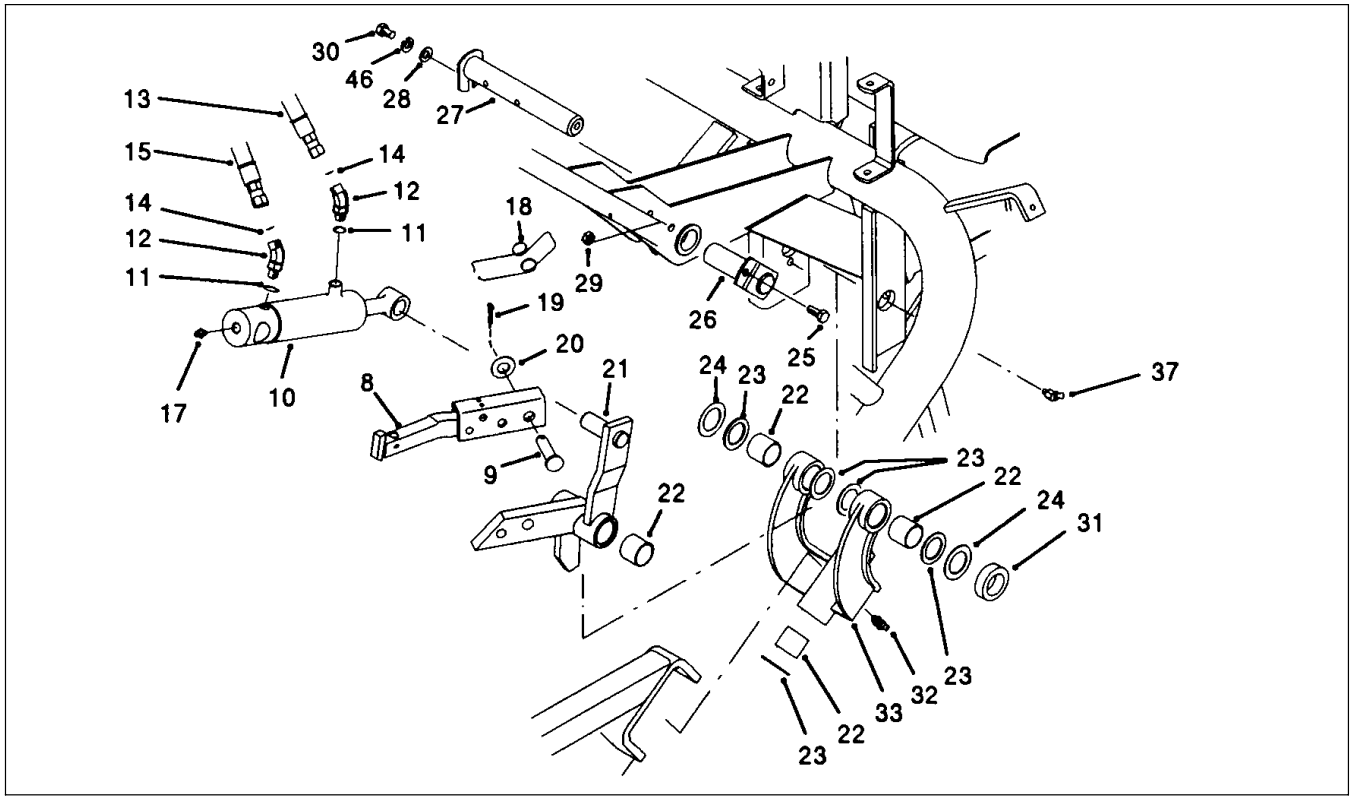


Figure 32

1. Put drain pan under machine.

2. Remove hydraulic lines.

3. Remove capscrew (Item 25) and locknut (Item 29) securing pin (Item 26) in barrel end of cylinder (Item 10).

4. Remove pin (Item 26) securing barrel end of cylinder to the frame.

5. Remove cylinder (Item 10) by lowering barrel end and sliding shaft/clevis end off of the lift arm (Item 21).

6. Reverse steps 2 - 5 to install the cylinder. Coat cylinder pivot on lift arm (Item 21) with Never-Seez or grease to achieve free pivot action of lift arm in cylinder clevis before reinstalling.

IMPORTANT: When disassembling hydraulic lines make sure hydraulic plugs are placed in the open end of the hydraulic line to prevent foreign debris from contaminating hydraulic oil. It is also a good idea to tag the hydraulic lines when disassembling so they can be properly reassembled. Keep all hydraulic lines clean and free from foreign debris. During replacement of lift cylinder, avoid overtightening fittings. Check hydraulic lines for cracks or breaks. If a hydraulic leak should appear after replacement of lift cylinder, replace the fitting or line that is leaking. Check hydraulic reservoir for level of hydraulic fluid after replacement of lift cylinder.

No. 2 and 3 Lift Cylinders (Fig. 33)

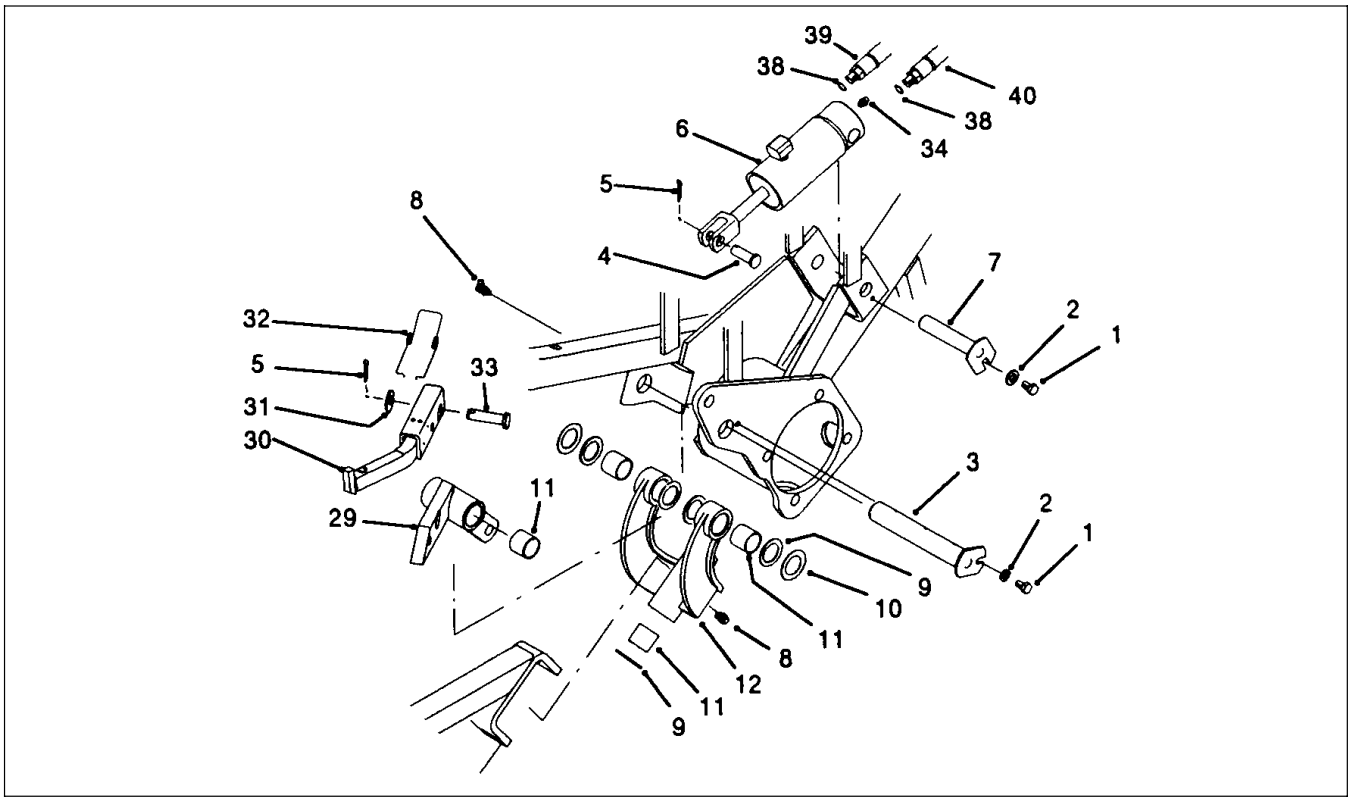


Figure 33
(L.H. side shown)

1. Remove the tool box to gain access to No. 2 cylinder. Remove the cover plate to gain access to No. 3 cylinder. Other disassembly procedures are the same for both cylinders.

2. Put drain pan under machine and remove hydraulic lines.

3. Remove cotter pin (Item 5) and clevis pin (Item 4) from cylinder rod.

4. Remove capscrew (Item 1) securing pin (Item 7) to frame and remove pin and cylinder (Item 6) from machine.

5. Reverse steps 2 - 5 to install the lift cylinder. Coat the hinge pin with Never-Seez or grease to achieve free pivot action of the cylinder before reassembling.

IMPORTANT: When disassembling hydraulic lines make sure hydraulic plugs are placed in the open end of the hydraulic line to prevent foreign debris from contaminating hydraulic oil. It is also a good idea to tag the hydraulic lines when disassembling so they can be properly reassembled. Keep all hydraulic lines clean and free from foreign debris. During replacement of lift cylinder, avoid overtightening fittings. Check hydraulic lines for cracks or breaks. If a hydraulic leak should appear after replacement of lift cylinder, replace the fitting or line that is leaking. Check hydraulic reservoir for level of hydraulic fluid after replacement of lift cylinder.

Lift Cylinder Repair – No. 1 (Center) (Fig. 34)

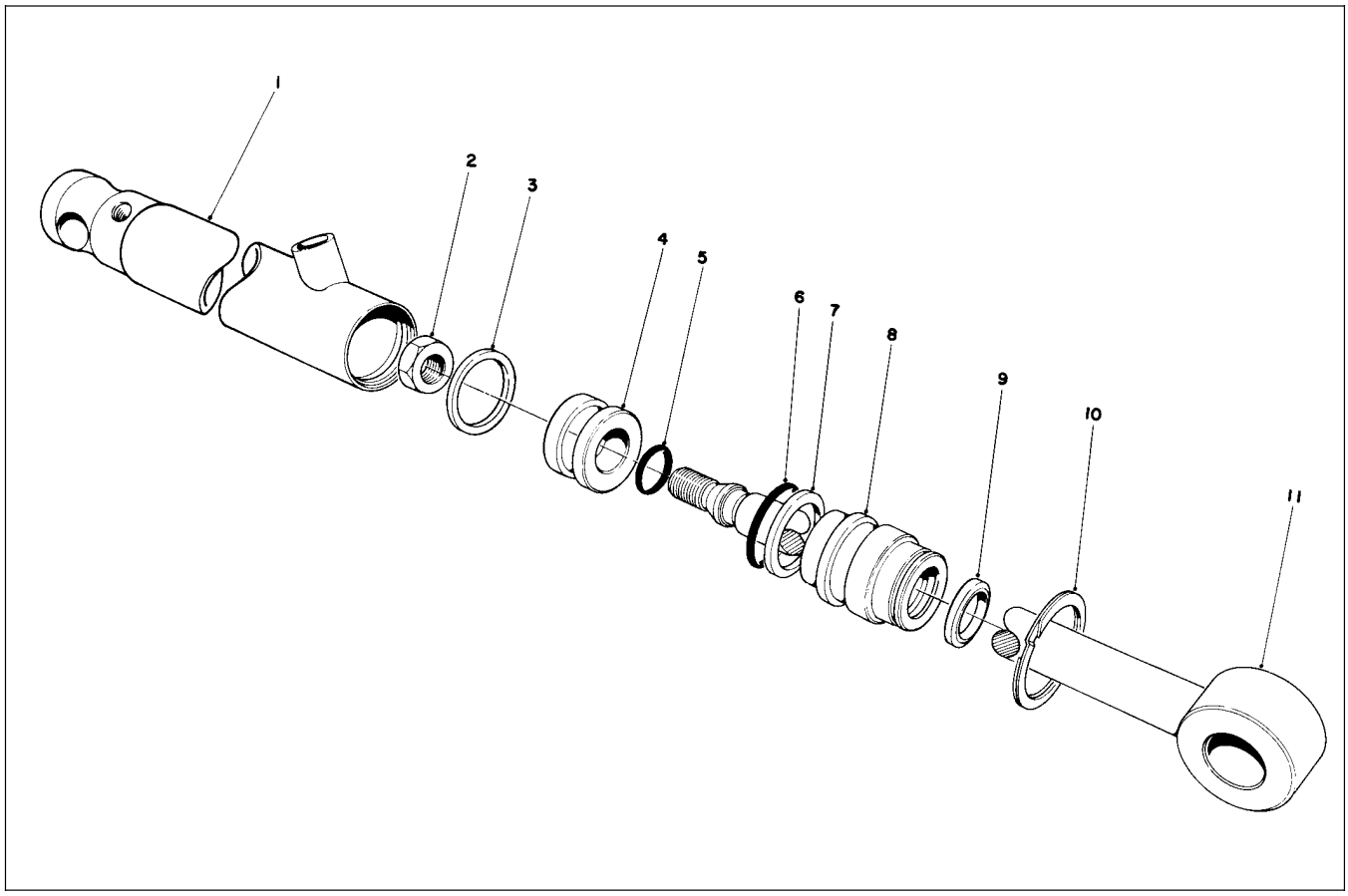


Figure 34

IMPORTANT: To prevent damage when clamping the cylinder barrel in a vise, clamp only on the pivot end. Do not clamp the vise jaws against the smooth shaft surface. Protect the shaft surface before mounting in the vise.

1. After removing the cylinder, pump the oil out of the cylinder into a drain pan by SLOWLY moving the cylinder's piston in and out of the cylinder bore.

2. Plug the ports and clean the outside of the cylinder.

3. Mount the cylinder in a vise so the shaft end of the cylinder is tilted up slightly. Do not close the vise so firmly that the barrel could become distorted.

4. Remove the retaining ring (Item 10). Grasp clevis end of shaft (Item 11) and use a twisting and pulling motion to carefully extract piston (Item 4), shaft (Item 11), and head (Item 8) from the barrel (Item 1).

5. Securely mount the shaft (Item 11) in a vise and remove the lock nut (Item 2) from the piston end of the shaft. Remove the piston (Item 4). Slide the head (Item 8) off of the shaft.

6. Remove and discard all seals and back-up rings (Items 3, 5, 6, 7, 9).

7. Wash the parts in a safe solvent. Dry the parts with compressed air. DO NOT wipe them dry with a cloth or paper as lint and dirt may remain.

8. Inspect the internal surface of the barrel (Item 1) for damage (deep scratches, out-of-round, etc.). Inspect the head (Item 8), shaft (Item 11) and piston (Item 4) for evidence of excessive scoring, pitting, or wear. Replace any defective parts.

9. Put a light coating of hydraulic oil on all new seals and back-up washers. Install the new seals and back-up washers (Items 3, 5, 6, 7, 9). Install the head (Item 8) onto the shaft (Item 11). Install the piston (Item 4) onto the shaft and tighten the lock nut (Item 2).

10. Put a light coating of hydraulic oil on all cylinder parts to ease assembly. Slide the shaft assembly and head into the barrel. Install the retaining ring (Item 10) to secure the assembly in the barrel.

Lift Cylinder Repair – No. 2 and 3 (Left and Right) (Fig. 35)

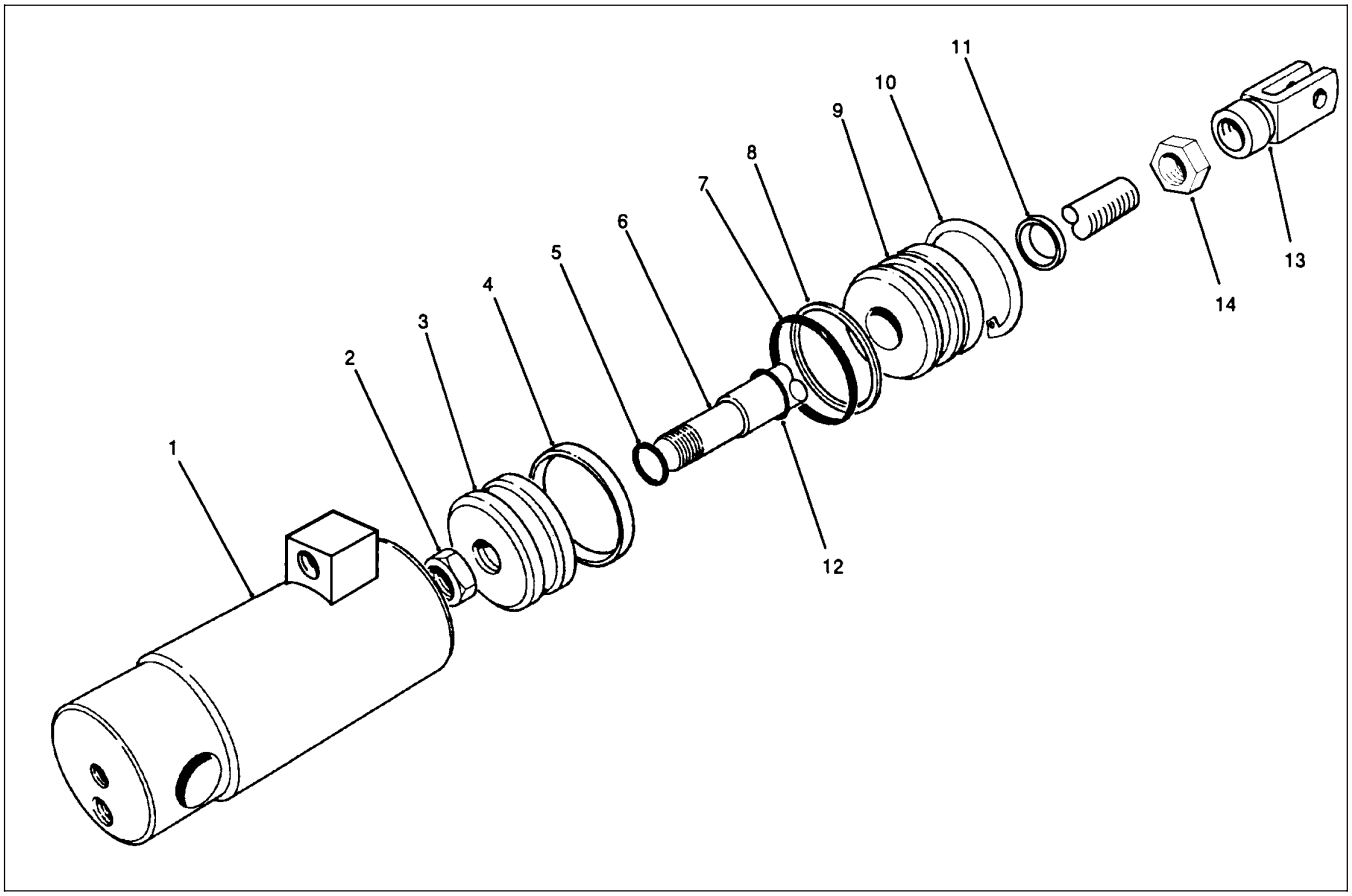


Figure 35

IMPORTANT: To prevent damage when clamping the cylinder barrel in a vise, clamp only on the pivot end. Do not clamp the vise jaws against the smooth shaft surface. Protect the shaft surface before mounting in the vise.

1. After removing the cylinder, pump the oil out of the cylinder into a drain pan by SLOWLY moving the cylinder's piston in and out of the cylinder bore.

2. Plug the ports and clean the outside of the cylinder.

3. Mount the cylinder in a vise so the shaft end of the cylinder is tilted up slightly. Do not close the vise so firmly that the barrel could become distorted.

4. Remove the retaining ring (Item 10). Grasp clevis (Item 13) at end of shaft and use a twisting and pulling motion to carefully extract piston (Item 3), shaft (Item 6), and head (Item 9) from the barrel (Item 1).

5. Securely mount the shaft (Item 6) in a vise and remove the lock nut (Item 2) from the piston end of the shaft. Remove the piston (Item 3). Slide the head (Item 9) off of the shaft.

6. Remove and discard all seals and back-up rings (Items 4, 5, 12, 7, 8, 11).

7. Wash the parts in a safe solvent. Dry the parts with compressed air. DO NOT wipe them dry with a cloth or paper as lint and dirt may remain.

8. Inspect the internal surface of the barrel for damage (deep scratches, out-of-round, etc.). Inspect the head, shaft and piston for evidence of excessive scoring, pitting, or wear. Replace any defective parts.

9. Put a light coating of hydraulic oil on all new seals and back-up washers. Install the new seals and back-up washers (Items 4, 5, 12, 7, 8, 11). Install the head (Item 9) onto the shaft (Item 6). Install the piston (Item 3) onto the shaft and tighten the lock nut (Item 2).

10. Put a light coating of hydraulic oil on all cylinder parts to ease assembly. Slide the piston, shaft and head into the barrel. Install the retaining ring (Item 10) to secure the assembly in the barrel.

Wheel Motor Removal and Installation (Fig. 36)

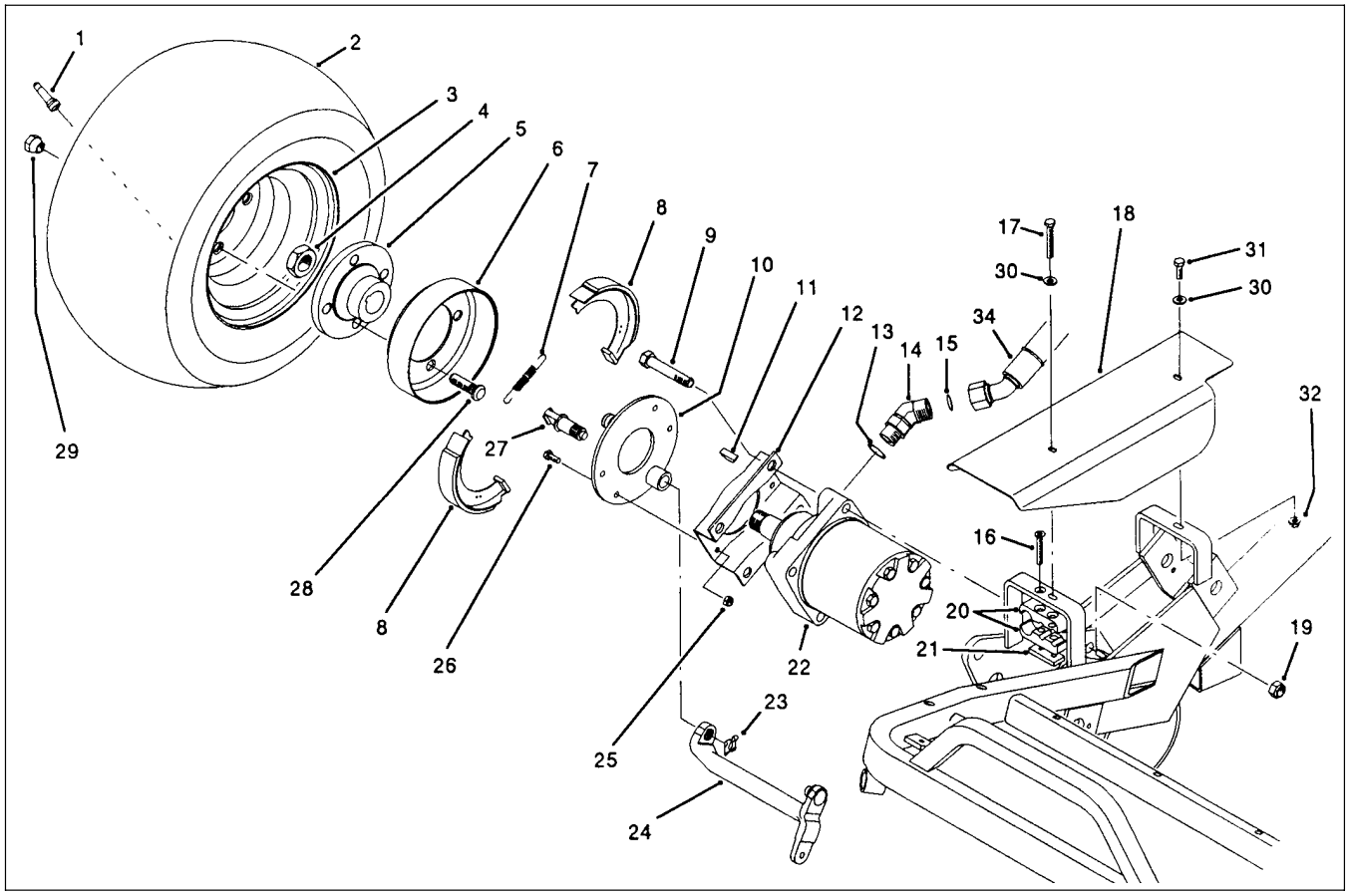


Figure 36

1. Put blocks on each side off opposite drive wheel. Lift the frame with a jack and use blocks or a jack stand to support the frame.

2. Remove wheel nuts (Item 29) and remove wheel (Item 3). Remove large nut (Item 4) from wheel hub (Item 5).

IMPORTANT: To prevent damage to wheel motor, DO NOT hit wheel hub with a hammer during removal or installation.

3. Mount a wheel puller to wheel mount studs and remove wheel hub (Item 5) and brake drum (Item 6). Remove key (Item 11) from wheel motor shaft.

4. Disconnect hydraulic lines from fittings on wheel motor (Item 22). Put caps on open lines and fittings to prevent contamination.

5. Remove four (4) capscrews (Item 9) and lock nuts (Item 19) to remove wheel motor (Item 22) and brake brackets (Item 12) from frame.

6. Reverse steps 1 - 6 to install the wheel motor. Tighten nut (Item 4) to a torque of 250 - 400 ft-lb.

IMPORTANT: When disassembling hydraulic lines make sure hydraulic plugs are placed in the open end of the hydraulic line to prevent foreign debris from contaminating hydraulic oil. It is also a good idea to tag the hydraulic lines when disassembling so they can be properly reassembled. Keep all hydraulic lines clean and free from foreign debris. During replacement of wheel motor, avoid overtightening fittings. Check hydraulic lines for cracks or breaks. If a hydraulic leak should appear after replacement of lift cylinder, replace the fitting or line that is leaking. Check hydraulic reservoir for level of hydraulic fluid after replacement of lift cylinder.

Wheel Motor Repair (Fig. 37, 38)

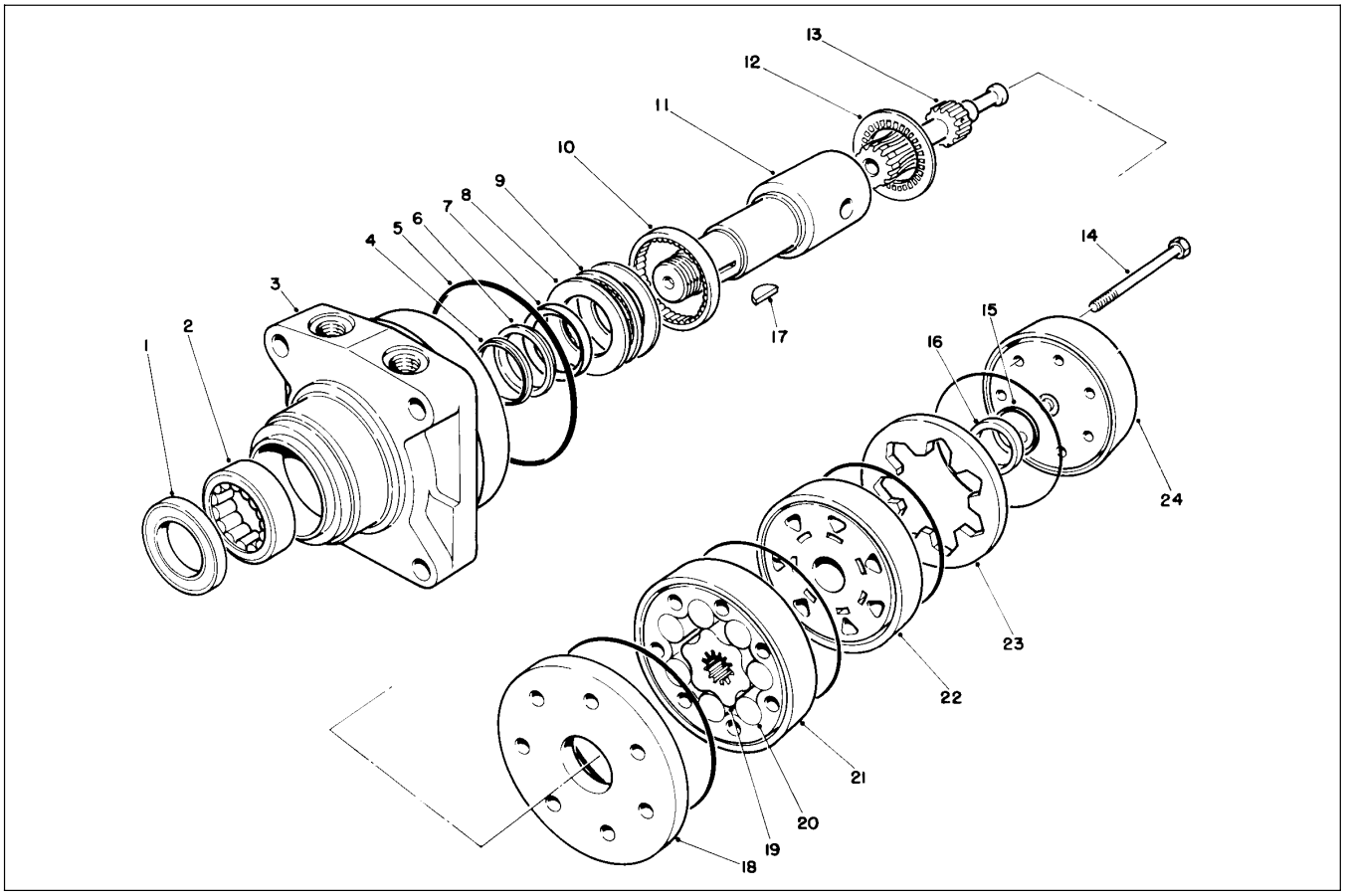


Figure 37

Disassembly of Motor (Fig. 37)

1. Place motor in a vise, clamping down on housing (Item 3) port bosses with coupling shaft (Item 11) pointed down.

CAUTION

If motor is not firmly held in the vise, it could be dislodged during the service procedures, causing personal injury.

2. Remove the seven (7) special bolts (Item 14) using a 9/16 inch thin wall socket. Inspect bolts for damaged threads, or sealing ring under bolt head. Replace damaged bolts.

3. Remove end cover assembly (Item 24) and seal ring (Item 5).

4. Thoroughly wash cover in solvent and blow dry. Make sure cover valve apertures, including internal orifice plug, are free of contamination. Inspect end cover for cracks and the bolt head recesses for good bolt head sealing surfaces. Replace cover as necessary.

5. Remove commutator ring (Item 23), commutator (Item 16), and manifold (Item 22).

6. Remove commutator seal (Item 15) from commutator (Item 16), using an air hose to blow air into ring groove until seal ring is lifted out and discard seal. Inspect commutator and commutator ring for cracks or burrs. Inspect commutator for wear, scoring, spalling or brinelling. If any of these conditions exist, replace commutator and commutator ring as a matched set.

7. Remove manifold (Item 22). Inspect manifold for cracks, surface scoring, brinelling or spalling. Replace manifold that shows any of these conditions. A polished pattern on the ground surfaces from commutator or rotor rotation is normal.

8. Remove rotor set (Item 19, 20, 21) and wear plate (Item 18). Retain rotor set in its assembled form to maintain the same rotor vane to stator contact surfaces. Inspect rotor set in its assembled form for nicks, scoring, or spalling, on any surface and broken or worn rotor splines. If any rotor set component requires replacement, the complete rotor set must be replaced as it is a matched set. Inspect the wear plate for cracks, brinelling, or scoring.

9. Place rotor set on a flat surface and center rotor (Item 19) in stator (Item 21) such that two rotor lobes are 180° apart and a roller vane (Item 20) centerline are on the same stator centerline. Check the rotor lobe to roller vane clearance with a feeler gage at this common centerline. If there is more than .005 inches (0.13 mm) of clearance, replace rotor set.

10. Remove drive link (Item 13) from coupling shaft (Item 11) if it was not removed with rotor set and wear plate. Inspect drive link for cracks and for worn or damaged splines. There should be no lash (play) between mating spline parts.

11. Remove thrust bearing (Item 12) and inspect for wear, brinelling, corrosion, and a complete set of rollers retained in position.

12. Remove coupling shaft (Item 11) by pushing on the output end of shaft. Inspect coupling shaft bearing and seal surfaces for spalling, nicks, grooves, severe wear or corrosion and discoloration. Inspect for damaged or worn keyway. Replace coupling shaft if any of these conditions exist.

NOTE: Minor shaft wear in seal area is permissible. If wear exceeds .020 inches (0.51 mm) diametrically, replace coupling shaft.

A slight “polish” is permissible in the shaft bearing area. Anything more would require coupling shaft replacement.

13. Remove inner seal (Item 7), back-up washer (Item 6) and back-up washer (Item 4). Discard seal and back up rings.

14. Remove housing (Item 3) from vise, turn over and re-clamp in vise with dirt seal (Item 1) end pointed up.

15. Remove dirt seal (Item 1) and discard.

16. Inspect housing (Item 3) assembly for cracks, the machined surfaces for nicks, burrs, brinelling or corrosion. Remove burrs that can be removed without changing dimensional characteristics. Inspect tapped holes for thread damage.

17. Inspect the bearings (Item 2, 9, 10) and thrust washers (Item 8). The bearing rollers must be firmly retained in the bearing cages, but must rotate and orbit freely. All rollers and the thrust washers must be free of brinelling and corrosion.

Before Assembling Motor

Replace all seals and seal rings with new ones. Lubricate all seals and seal rings with hydraulic oil or clean grease before assembly.

NOTE: Unless otherwise indicated, do not oil or grease parts before assembly.

Wash all parts in clean petroleum-based solvents before assembly. Blow them dry with compressed air. Remove any paint chips from mating surfaces of the end cover, sleeve, and housing and from port and sealing areas.

Assembly of Motor (Fig. 37, 38)

1. Place housing (Item 3) in a vise and clamp down on housing port bosses with large bore end pointed up. Apply clean grease to new seal (Item) and assemble into housing with seal lip pointed inward.

2. Install back-up washer (Item 4) into housing. Install back-up washer (Item 6) into housing with beveled side facing out so it will mate to inner seal (Item 7).

3. Apply a small amount of clean grease to back side of new inner seal (Item 7) and assemble into housing.

4. Lubricate and assemble coupling shaft (Item 11), firmly seating it against thrust washer (Item 8).

5. Assemble thrust bearing (Item 12) onto end of coupling shaft (Item 11).

6. Assemble drive link (Item 13) into coupling shaft (Item 11) with their splines in mesh. Align hole in drive link with hole in coupling shaft.

NOTE: Two alignment studs screwed finger tight into housing (Item) bolt holes, approximately 180° apart, will facilitate the assembly and alignment of components as required in the following procedures.

NOTE: Make sure new seal rings (Item 5) are installed between each section of motor as it is assembled.

7. Assemble wear plate (Item 18) over drive link and studs onto housing.

8. Install assembled rotor set (Item 21) with counterbore in rotor (Item 19) down, if applicable, and splines in mesh with drive link splines.

NOTE: If necessary, go to “Rotor, Stator, Vane Assembly” procedures on next page.

9. Assemble manifold (Item 22) and then the commutator ring (Item 23) over the drive link onto rotor set. Be sure swirls in manifold and manifold plate are installed facing together.

10. Assemble a new commutator seal (Item 15), flat side up, into commutator (Item 16) and assemble commutator over end of drive link onto manifold with seal side up.

11. Install end cover (Item 24). Assemble special bolts (Item 14) and screw in finger tight. Removal of the two alignment studs should be made after at least two bolts have been assembled. Alternately and progressively tighten the bolts to pull end cover assembly into place with final torque of 50 ± 5 ft.lbs. (68 ± 8 Nm).

12. Invert housing in vise so the coupling shaft (Item 11) is pointing up and install dust seal (Item 1). Seal should be pressing in flush to 0.02 inch below face.

NOTE: Torque required to rotate coupling shaft should not be more than 50 ft-lb (68 Nm).

Rotor, Stator and Vane Assembly (Fig. 37, 38)

1. Place stator (Item 21) onto wear plate (Item 18) after doing motor assembly procedures 1 through 7.

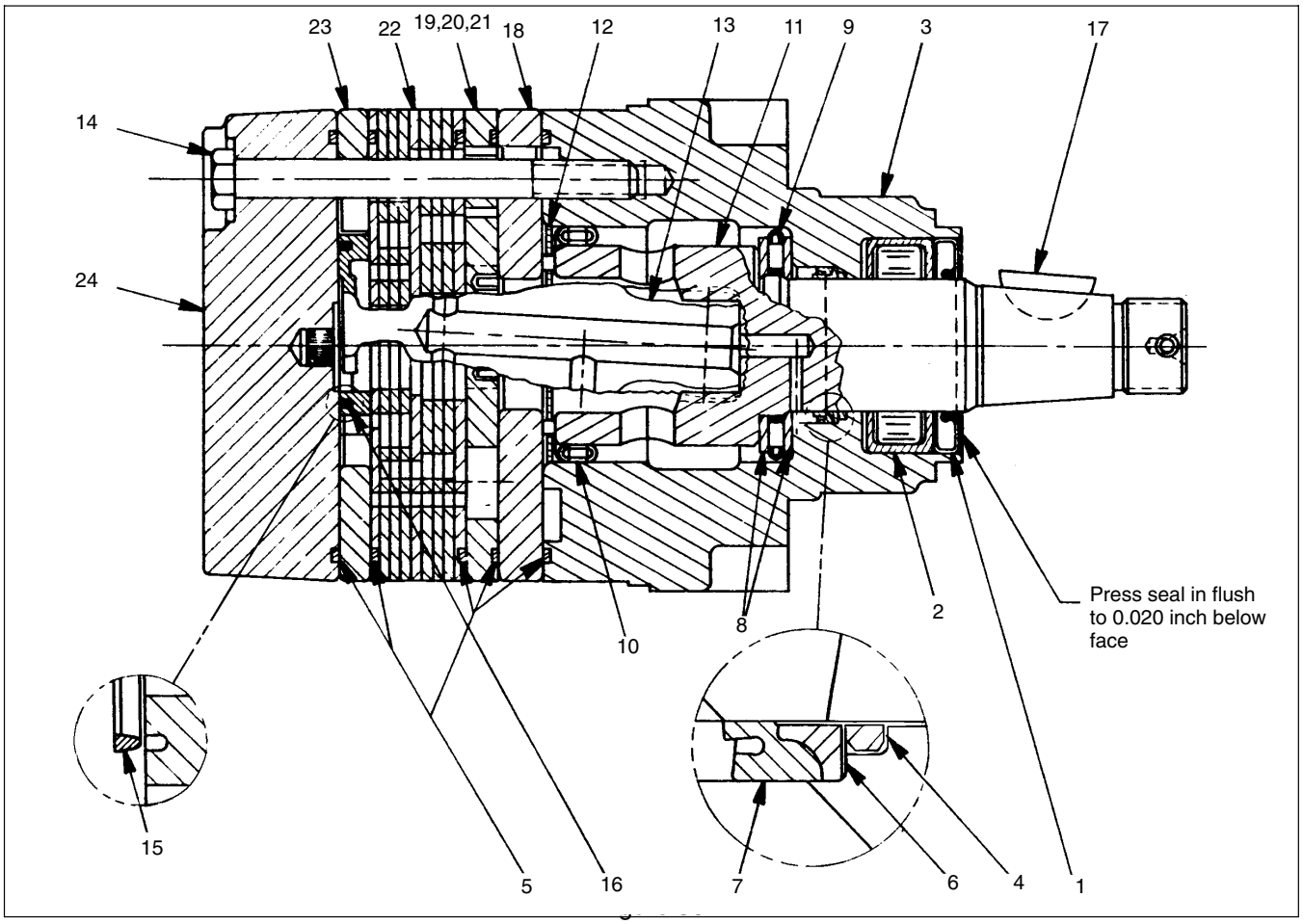
2. If assembly alignment studs are not being used, align stator bolt holes with wear plate bolt holes and turn two (2) bolts (Item 14) finger tight into bolt holes 180° apart to keep stator and wear plate stationary.

3. Assemble six vanes (Item 20) into the stator vane pockets.

4. Assemble rotor (Item 19), counterbore down, if applicable, into stator (Item 21) and onto wear plate (Item 18) with rotor splines in mesh with drive link splines.

5. Grasp output end of coupling shaft (Item 11) and rotate coupling shaft, drive link and rotor to seat the rotor and assembled vanes into stator, creating necessary clearance to assemble seventh (7th) vane. Assemble the seven (7) vanes using minimum force.

6. Remove the two assembled bolts if used to retain stator and wear plate.



Steering Cylinder Removal and Installation - Greensmaster 3100 (Fig. 39)

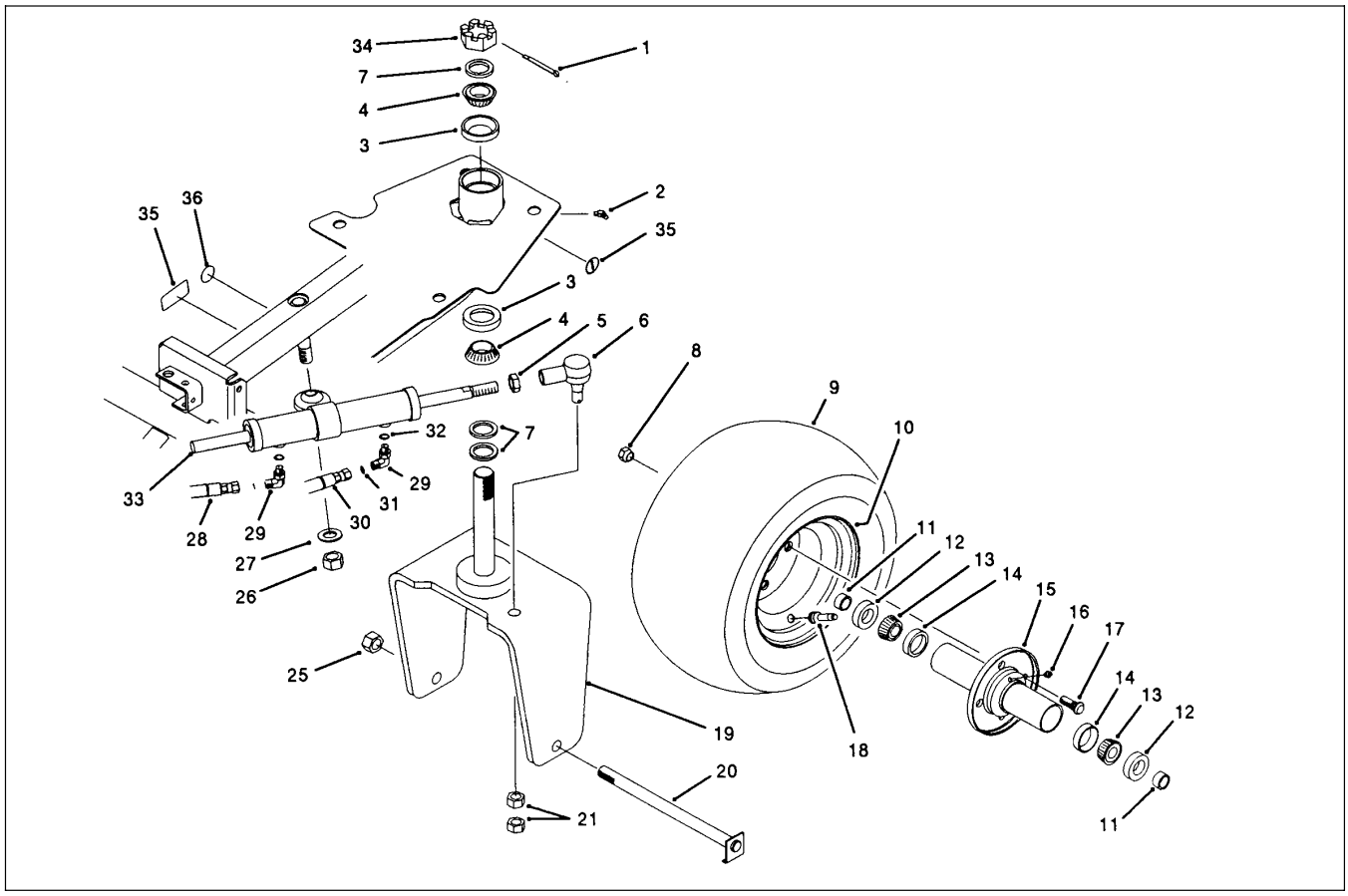


Figure 39

1. Disconnect the hydraulic hoses (Item 28, 29) from steering cylinder (Item 33). Put caps or plugs on all the fittings and hoses to prevent contamination.

NOTE: To ease reassembly, tag each of the hoses to show their correct position on the steering cylinder.

2. Remove jam nuts (Item 21) securing cylinder end to castor fork (Item 19).

3. Remove locknut (Item 26) and washer (Item 27) to remove cylinder from frame.

IMPORTANT: Before installing the cylinder make sure the distance between ball joint centers is 14.4 in. with cylinder rod completely retracted. Loosen jam nut and adjust ball joint if necessary, then tighten jam nut.

4. Reverse steps 1 - 3 to install the steering cylinder.

5. After installing the cylinder, start the engine and turn the steering wheel left and right from lock to lock several times to get air out of the cylinder.

IMPORTANT: When disassembling hydraulic lines make sure hydraulic plugs are placed in the open end of the hydraulic line to prevent foreign debris from contaminating hydraulic oil. It is also a good idea to tag the hydraulic lines when disassembling so they can be properly reassembled. Keep all hydraulic lines clean and free from foreign debris. During replacement of steering cylinder, avoid overtightening fittings. Check hydraulic lines for cracks or breaks. If a hydraulic leak should appear after replacement of lift cylinder, replace the fitting or line that is leaking. Check hydraulic reservoir for level of hydraulic fluid after replacement of lift cylinder.

Steering Cylinder Repair - Greensmaster 3100 (Fig. 40)

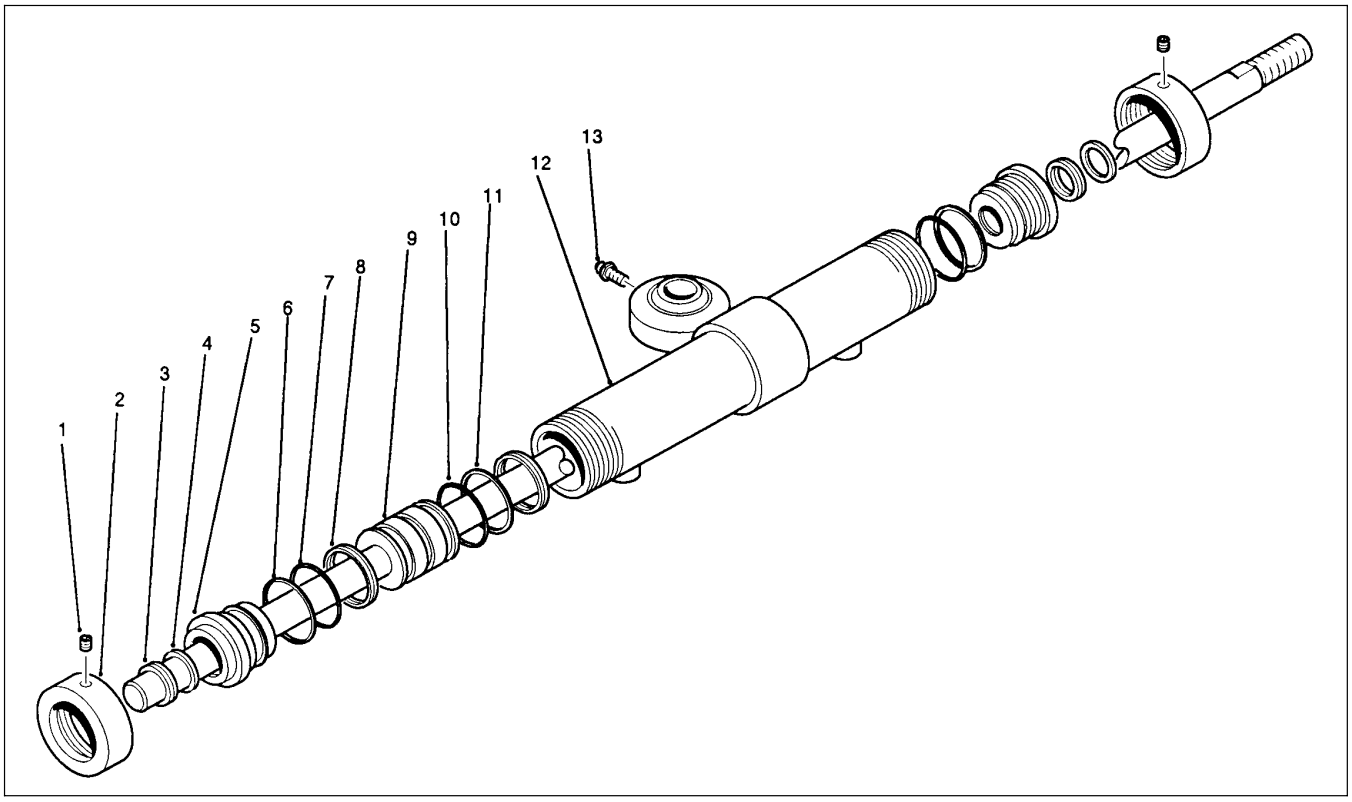


Figure 40

IMPORTANT: To prevent damage when clamping the cylinder barrel in a vise, clamp only on the pivot end. Do not clamp the vise jaws against the smooth shaft surface. Protect the shaft surface before mounting in the vise.

1. After removing the cylinder, pump the oil out of cylinder ports into a drain pan by SLOWLY moving rod in and out of cylinder bore.

2. Plug the ports and clean the outside of the cylinder.

3. Mount the cylinder in a vise by clamping vise on center mounting location of cylinder.

4. Loosen setscrews (Item 1) and remove threaded end caps (Item 2) from each end of barrel (Item 12).

5. Grasp flats on threaded end of rod and use a twisting and pulling motion to carefully remove rod assembly (Item 9) and head from the barrel. Remove head (Item 5) from other end of barrel.

6. Slide head off of rod assembly.

7. Remove and discard all seals and back-up rings.

8. Wash parts in solvent. Dry the parts with compressed air. DO NOT wipe them dry with a cloth or paper as lint and dirt may remain.

9. Inspect internal surface of barrel for damage (deep scratches, out-of-round, etc.). Inspect head and rod assembly for evidence of excessive scoring, pitting, or wear. Replace any damaged or worn parts.

10. Put a light coating of hydraulic oil on all new seals and back-up washers. Install the new seals and back-up washers.

11. Put a light coating of hydraulic oil on all cylinder parts to ease assembly. Slide rod assembly (Item 9) into barrel. Install head (Item 5) to each end of barrel.

12. Install threaded cap (Item 2) on each end of barrel and tighten setscrews (Item 1).

Steering Control Unit Removal and Installation - Greensmaster 3100 (Fig. 41)

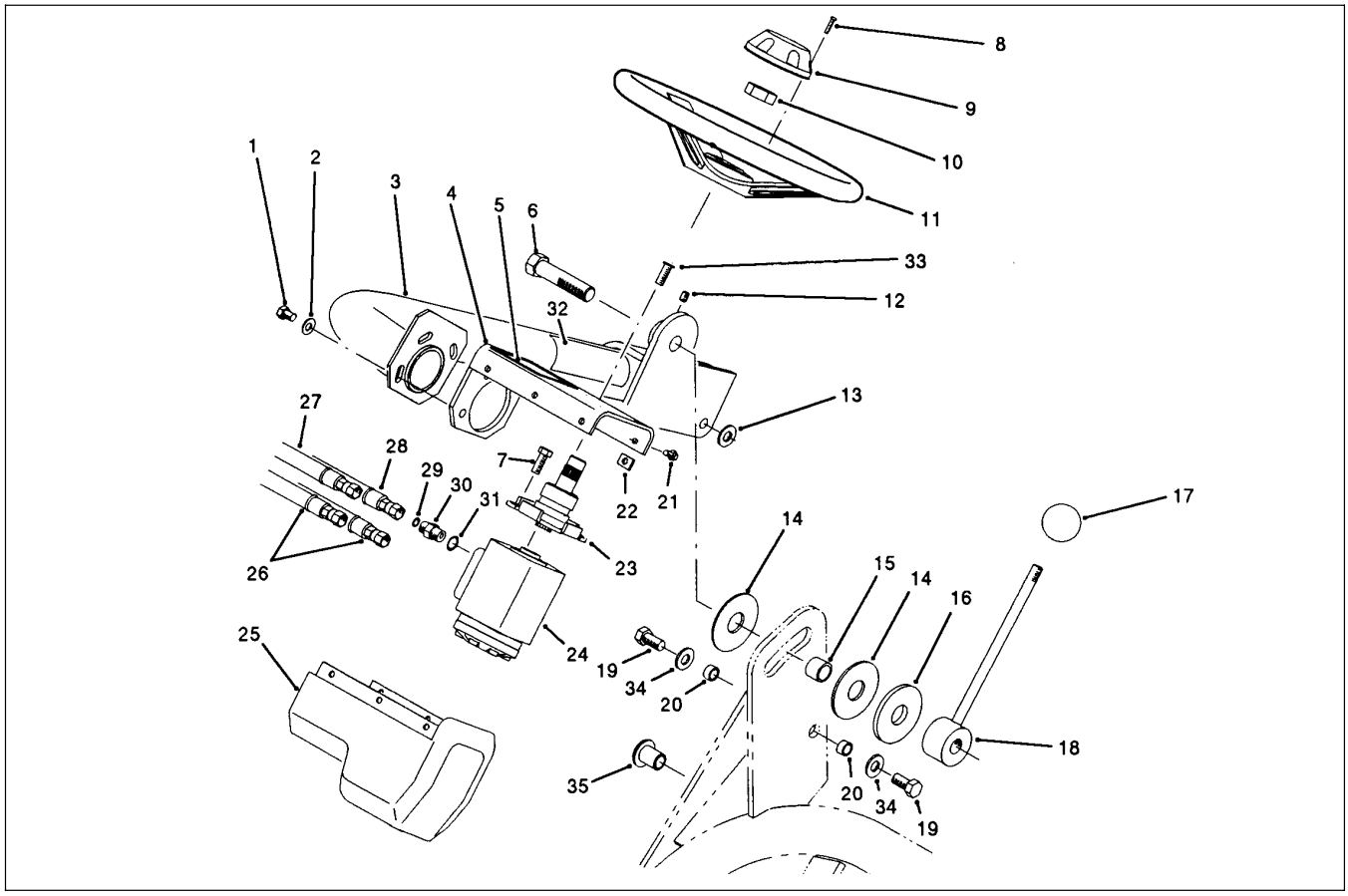


Figure 41

1. Remove six (6) capscrews (Item 21) and remove the steering cover (Item 25).

2. Clean the outside of the steering valve and the area around the hydraulic fittings. Disconnect the hydraulic hoses from the steering valve (Item 24). Put caps or plugs on all the fittings and hoses and tubes to prevent contamination.

NOTE: To ease reassembly, tag each of the hoses to show their correct position on the steering valve.

3. Remove the steering wheel cap (Item 9) from the steering wheel (Item 11). Remove the locknut (Item 10) that secures the steering wheel to the shaft. Pull the steering wheel off the shaft.

NOTE: It may be necessary to use a jaw-type puller to remove the steering wheel from the steering shaft.

IMPORTANT: DO NOT hit the steering shaft with a hammer. This could damage the steering valve components.

4. Remove four capscrews (Item 7) and lower the steering valve (Item 24) and steering column (Item 23) out of the steering arm.

5. Reverse steps 1 - 4 to install the steering valve. Tighten the steering wheel nut so the top surface of the nut is flush with the top of the steering column.

IMPORTANT: When disassembling hydraulic lines make sure hydraulic plugs are placed in the open end of the hydraulic line to prevent foreign debris from contaminating hydraulic oil. It is also a good idea to tag the hydraulic lines when disassembling so they can be properly reassembled. Keep all hydraulic lines clean and free from foreign debris. During replacement of steering valve, avoid overtightening fittings. Check hydraulic lines for cracks or breaks. If a hydraulic leak should appear after replacement of lift cylinder, replace the fitting or line that is leaking. Check hydraulic reservoir for level of hydraulic fluid after replacement of lift cylinder.

Steering Control Unit Repair - Greensmaster 3100 (Fig. 42)

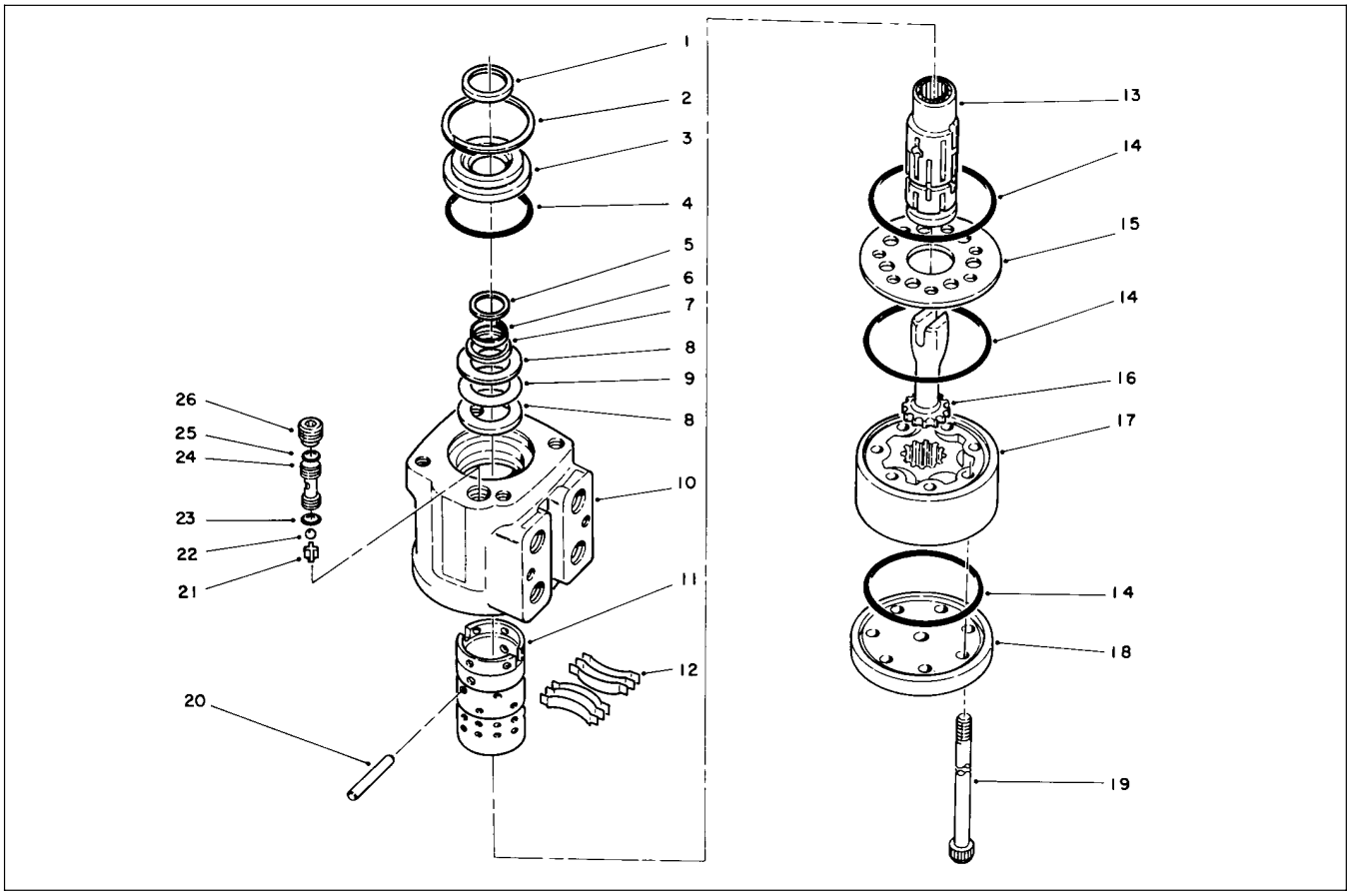


Figure 42

1. Dust seal
2. Retaining ring
3. Gland bushing seal
4. O-ring
5. Backup ring
6. O-ring
7. Seal
8. Bearing race
9. Needle thrust bearing
10. Housing
11. Control sleeve
12. Control spool centering springs
13. Control spool
14. O-ring
15. Spacer plate
16. Drive
17. Gerotor
18. End cap
19. Capscrew
20. Centering pin kit
21. Check ball retainer
22. Check ball
23. O-ring
24. Check ball seat
25. O-ring
26. Setscrew

Disassembly

Cleanliness is extremely important when repairing a steering control unit. Work in a clean area. Before disconnecting lines, clean port area of unit thoroughly. Use a wire brush to remove foreign material and debris from around exterior joints of the unit.

Although not all drawings show the unit in a vise, it is recommended that you keep the unit in the vise during disassembly. Follow the clamping procedures explained in the instructions.

Meter (Gerotor) End Disassembly

1. Clamp unit in vise, meter end up. Clamp lightly on edges of mounting area. Use protective material on vise jaws. Housing distortion could result if jaws are over-tightened.

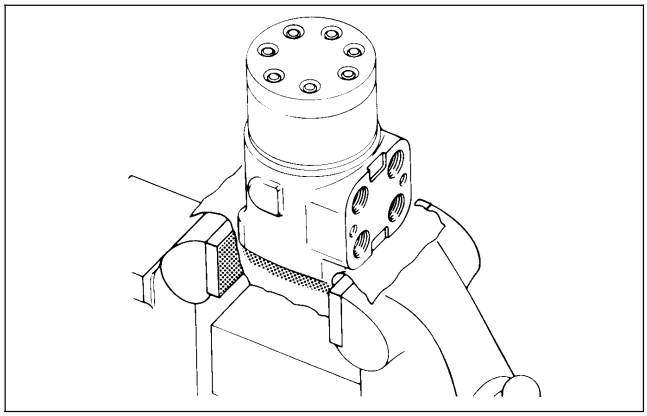


Figure 43

2. Remove 5/16" cap screws.

3. Remove end cap.

4. Remove seal from end cap.

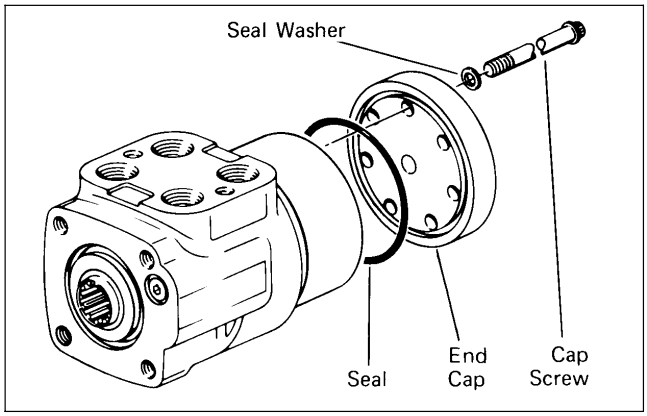


Figure 44

5. Remove meter. Be careful not to drop star.

6. Remove seal from meter.

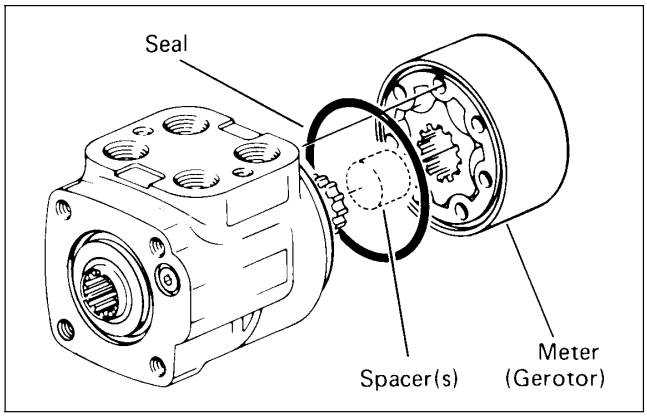


Figure 45

7. Remove drive.

8. Remove spacer plate.

9. Remove seal from housing.

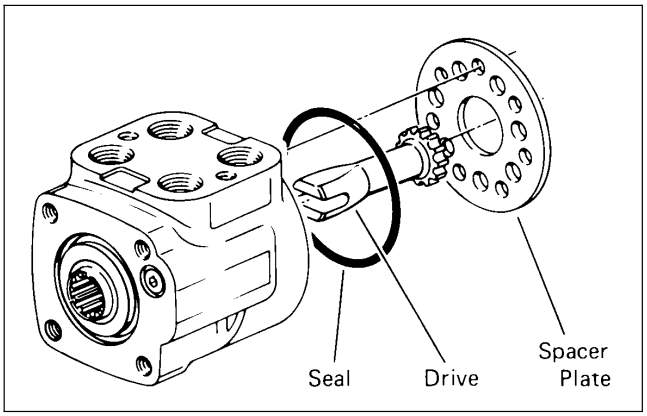


Figure 46

Control End Disassembly

10. Remove housing from vise. Place housing on a clean soft cloth to protect surface finish. Use a thin blade screwdriver to pry retaining ring from housing.

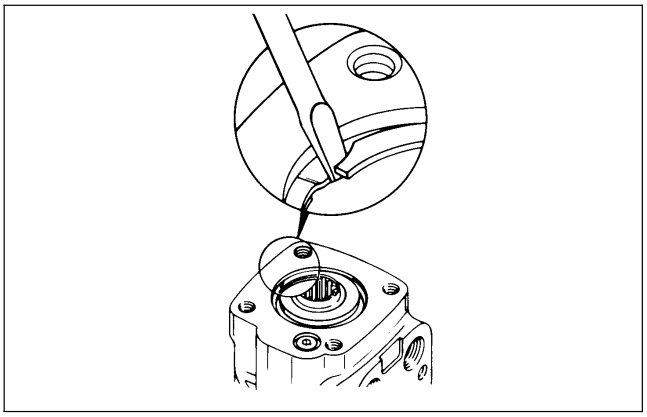


Figure 47

11. Rotate spool and sleeve until pin is horizontal. Push spool and sleeve assembly forward with your thumbs just far enough to free gland bushing from housing. Remove bushing.

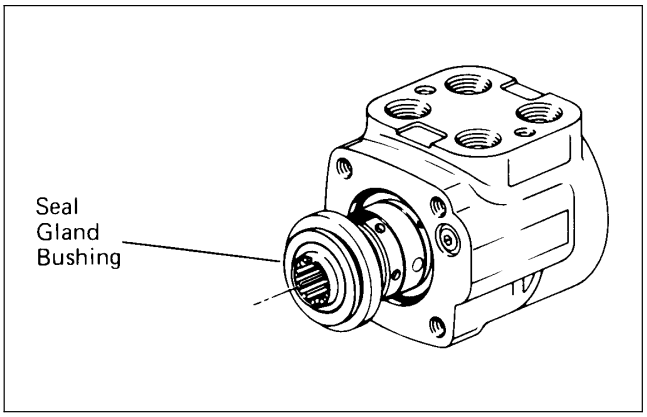


Figure 48

12. Remove quad-ring seal from seal gland bushing.

13. Use a thin blade screwdriver to pry dust seal from seal gland bushing. Do not damage bushing.

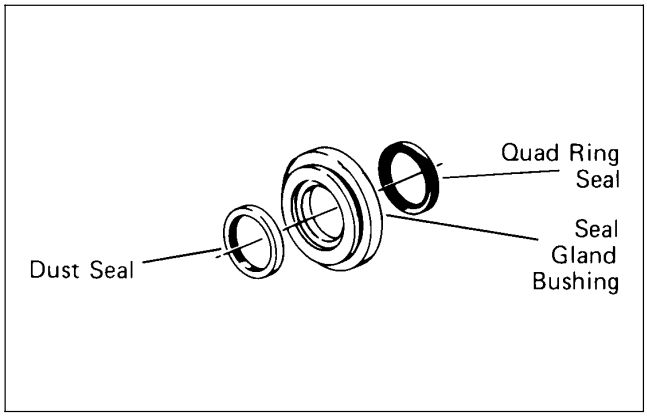


Figure 49

14. Remove 2 bearing races and the needle thrust bearing from spool and sleeve assembly.

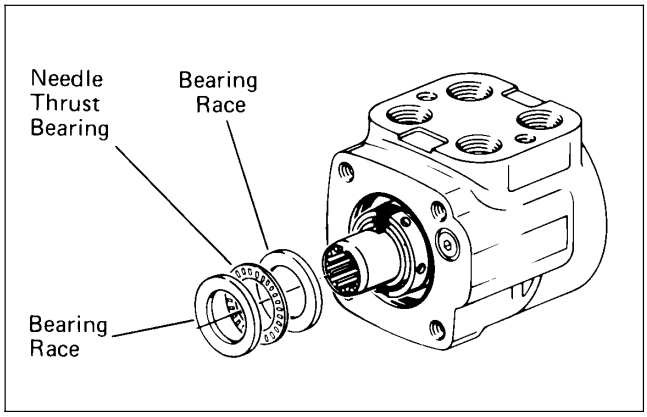


Figure 50

15. Remove spool and sleeve assembly from 14 hole end of housing.

IMPORTANT: Do not bind spool and sleeve in housing. Rotate spool and sleeve assembly slowly when removing from housing.

16. Push pin from spool and sleeve assembly.

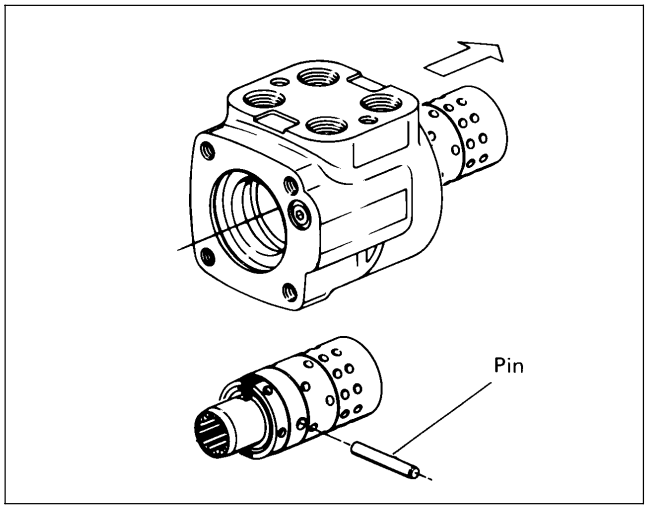


Figure 51

17. Push spool partially from control end of sleeve, then remove 6 centering springs from spool carefully by hand

18. Push spool back through and out of sleeve. Rotate spool slowly when removing from sleeve.

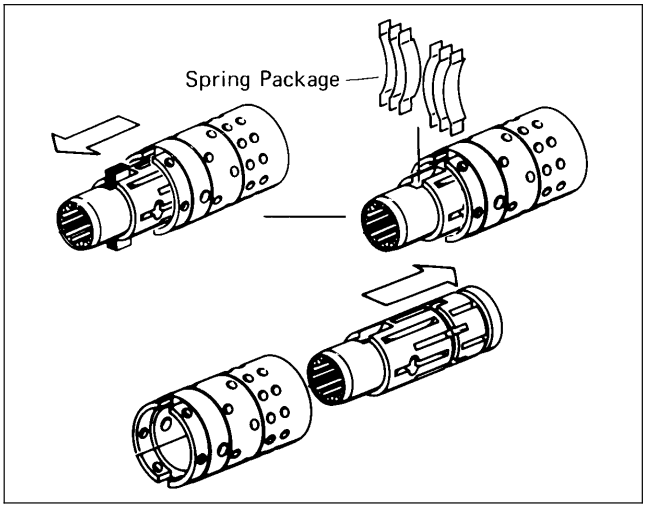


Figure 52

19. Remove seal from housing.

20. Remove set screw from housing.

21. Screw a #10-24 machine screw into end of check ball seat. Then by pulling on screw, with a pliers, lift seat out of housing.

22. Remove two (2) seals from check valve seat.

23. Tip housing to remove check ball and check ball retainer.

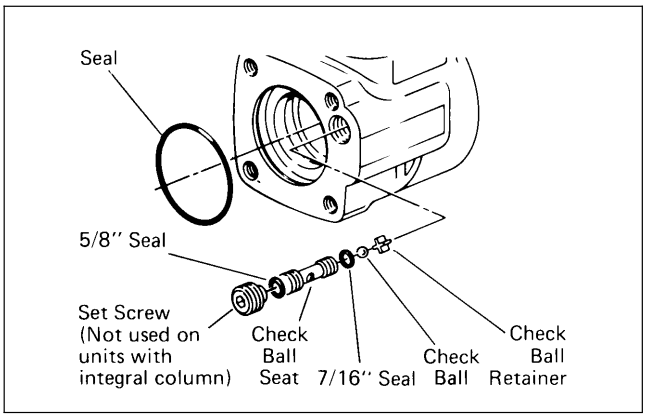


Figure 53

Reassembly

Check all mating surfaces. Replace any parts that have scratches or burrs that could cause leakage. Clean all metal parts in clean solvent. Blow dry with air. Do not wipe dry with cloth or paper towel because lint or other matter can get into the hydraulic system and cause damage. Do not use a coarse grit or try to file or grind these parts.

NOTE: Lubricate all seals with clean petroleum jelly such as Vaseline.

Do not use excessive lubricant on seals for meter section.

Refer to parts listings covering your steering control unit when ordering replacement parts. A good service policy is to replace all old seals with new seals.

Control End Reassembly

1. Use a needle nose pliers to lower check ball retainer into check valve hole of housing. Make sure retainer is straight (not tilted on edge) in housing.

2 Install check ball in housing.

3 Lubricate 5/8" diameter seal and 7/16" diameter seal. Install seals on check ball seat as shown

4. Lubricate check ball seat and seals thoroughly before installing seat in housing. When installing seat do not twist or damage seals. Install check ball seat in housing, insert open end of seat first. Push check ball seat to shoulder of hole.

5. Install set screw. Use a 1/4" allen wrench to torque set screw to 100 inch pounds. To prevent interference, make sure top of set screw is slightly below housing mounting surface.

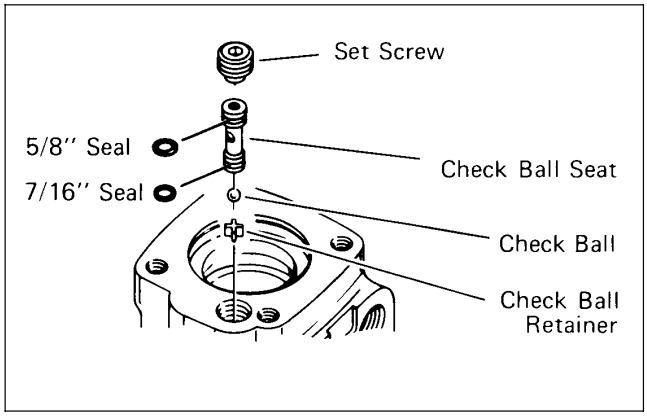


Figure 54

6. Assemble spool and sleeve carefully so that the spring slots line up at the same end. Rotate spool while sliding parts together. Some spool and sleeve sets have identification marks, align these marks as shown. Test for free rotation. Spool should rotate smoothly in sleeve with finger tip force applied at splined end.

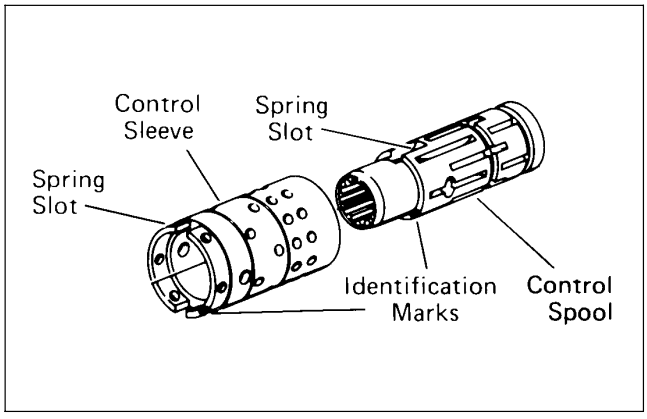


Figure 55

7. Bring spring slots of both parts in line and stand parts on end of bench. Insert spring installation tool through spring slots of both parts. Tool is available from a Eaton Hydraulics supplier as Eaton part no. 600057. Position 3 pairs of centering springs (or 2 sets of 3 each) on bench so that extended edge is down and arched center section is together. In this position, insert one end of entire spring set into spring installation tool with spring notches facing sleeve.

8. Compress extended end of centering spring set and push into spool sleeve assembly withdrawing installation tool at the same time.

9. Center the spring set in the parts so that they push down evenly and flush with the upper surface of the spool and sleeve.

10. Install pin through spool and sleeve assembly until pin becomes flush at both sides of sleeve.

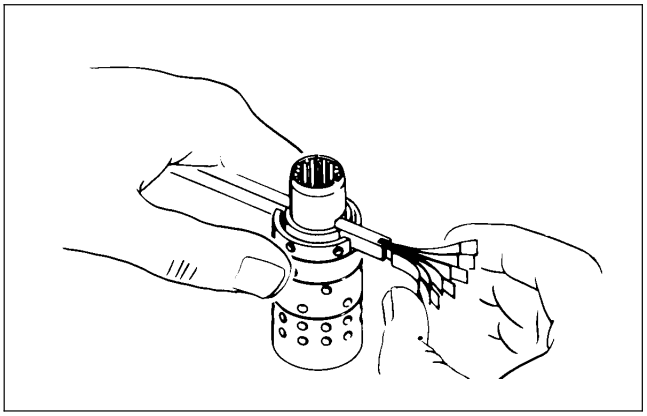


Figure 56

11. Position the spool and sleeve assembly so that the splined end of the spool enters the 14 hole end of housing first.

IMPORTANT: Be extremely careful that the parts do not tilt out of position while inserting. Push parts gently into place with slight rotating action, keep pin nearly horizontal. Bring the spool assembly entirely within the housing bore until the parts are flush at the meter end or 14 hole end of housing. Do not pull the spool assembly beyond this point to prevent the cross pin from dropping into the discharge groove of the housing. With the spool assembly in this flush position, check for free rotation within the housing by turning with light finger tip force at the splined end.

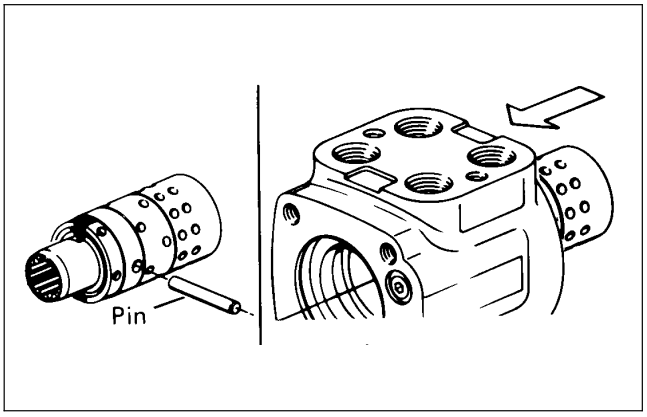


Figure 57

12. Place housing on clean, lint free cloth. Install 2-1/8" diameter seal in housing.

13. Install two (2) bearing races and the needle thrust bearing in the order shown .

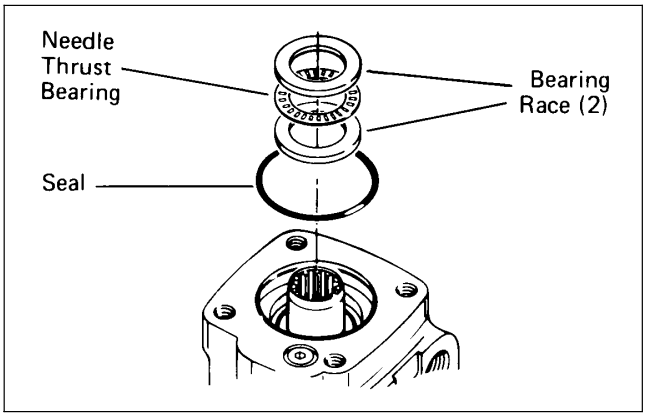


Figure 58

14. Install 1-1/4" diameter dust seal in seal gland bushing, flat or smooth side of dust seal must face down towards bushing, see Fig. 60.

15. Install the quad-ring seal in seal gland bushing. Smooth seal in place with your finger. Do not use any seal that falls freely into pocket of bushing, see Fig. 60.

16. Install seal gland bushing over the spool end with a twisting motion. Tap the bushing in place with a rubber hammer. Make sure the bushing is flush against the bearing race.

17. Install retaining ring (see Fig. 59 - 60) in housing. After installing ring, tap on ring end or pry with screwdriver around entire circumference of ring to properly seat ring in groove.

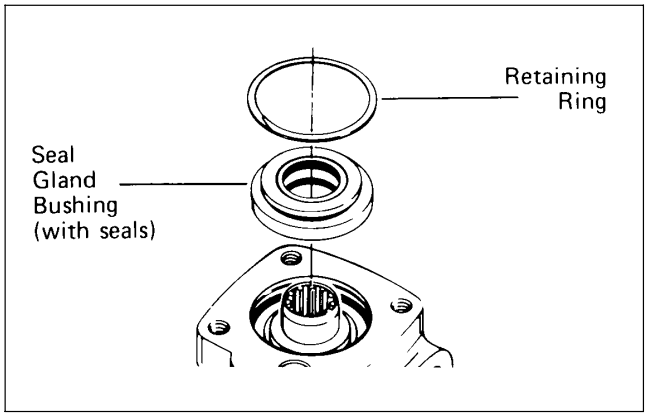


Figure 59

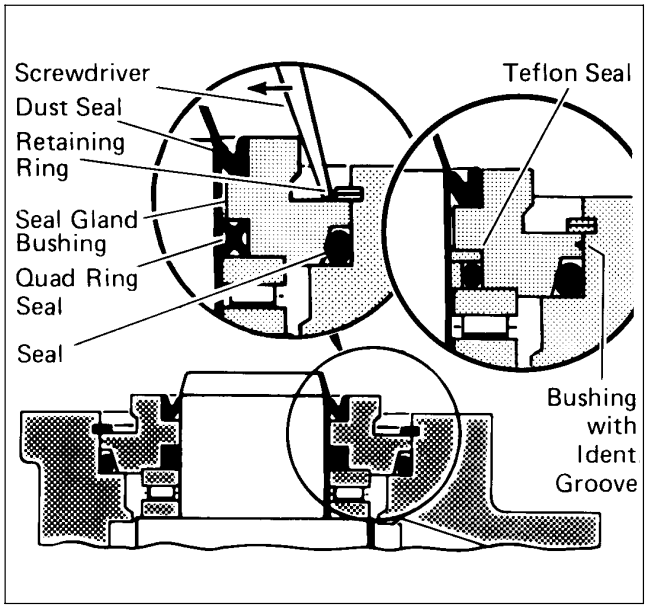


Figure 60

18. Clamp housing in vise, as shown. Clamp lightly on edges of mounting area. Do not over tighten jaws.

NOTE: Check to insure that the spool and sleeve are flush or slightly below the 14 hole surface of the housing.

IMPORTANT: Clean the upper surface of the housing by wiping with the palm of clean hand. Clean each of the flat surfaces of the meter section parts in a similar way when ready for reassembly. Do not use cloth or paper to clean surfaces.

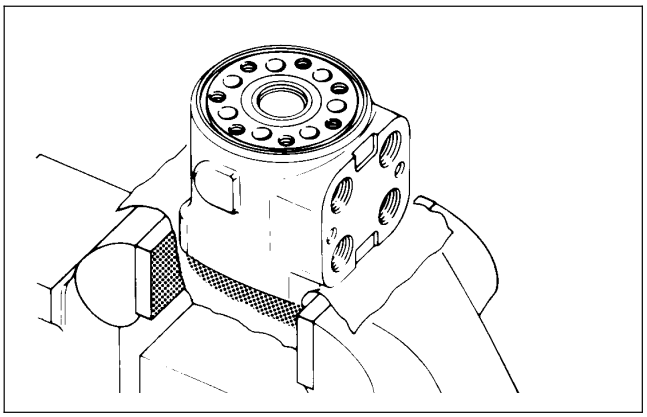


Figure 61

19. Install 3" diameter seal in housing.

20. Install spacer plate. Align bolt holes in spacer plate with tapped holes in housing.

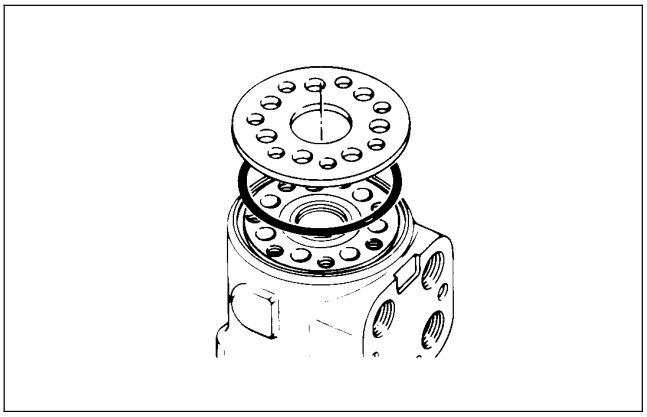


Figure 62

21. Rotate spool and sleeve assembly until pin is parallel with port face. Install drive, make sure you engage drive with pin, To assure proper alignment, mark drive as shown in Fig. 65 (ref. B). Note relationship between slotted end of drive to splined end of drive when marking.

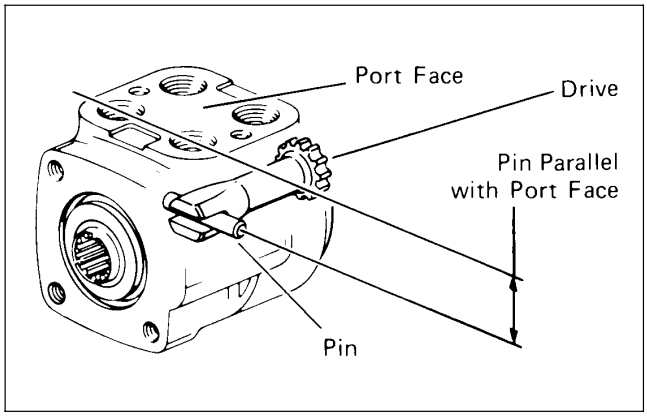


Figure 63

22. Install 3" diameter seal in meter.

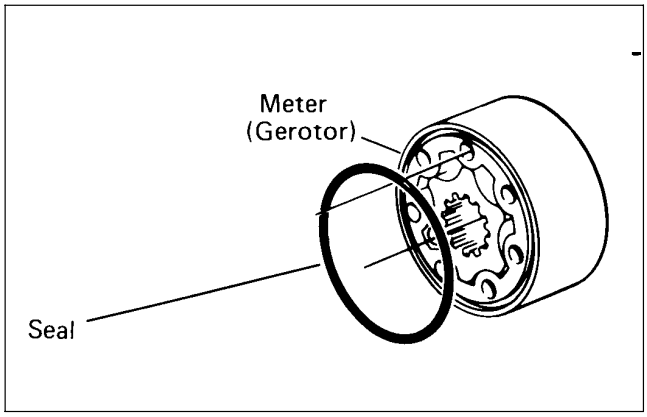


Figure 64

23. With seal side of meter toward spacer plate, align star valleys (ref. A) on drive (ref. B). Note the parallel relationship of reference lines A, B, C, and D. Align bolt holes without disengaging meter from drive.

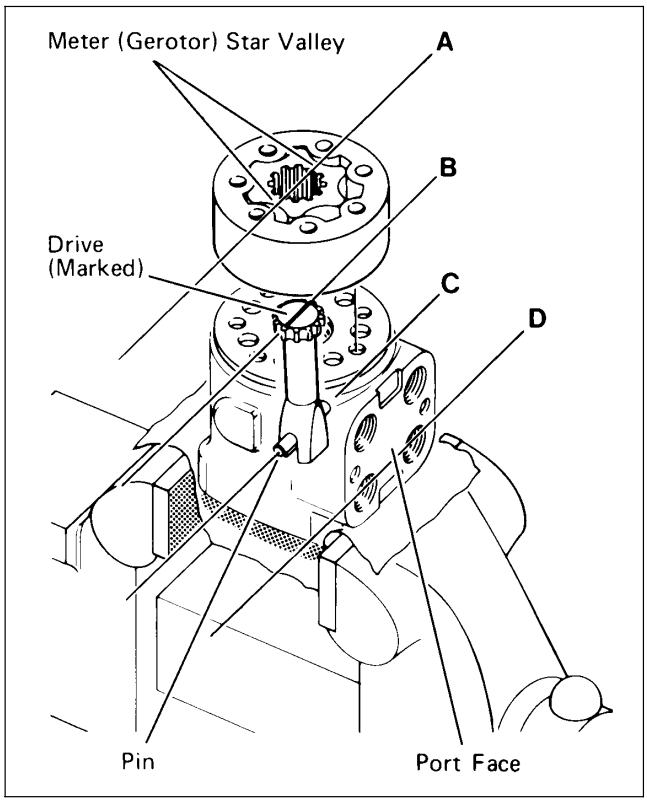


Figure 65

24. Install 3" diameter seal in end cap.

25. Install end cap on gerotor, align holes.

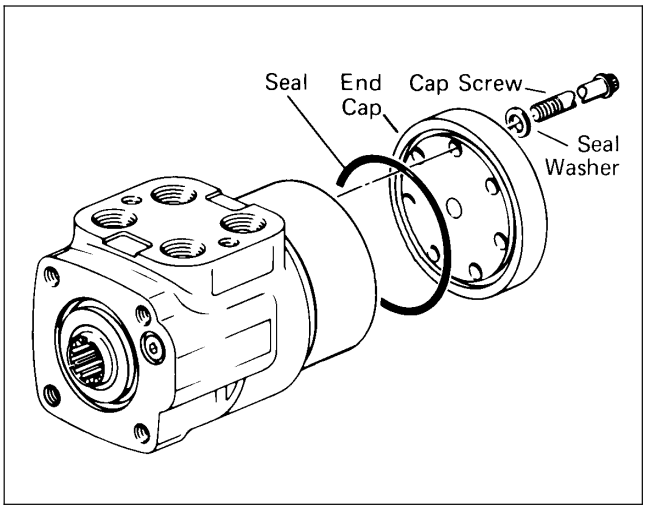


Figure 66

26. Install seven (7) DRY cap screws with new seal washers in end cap. Pre-tighten screws to 150 inch pounds, then torque screws to 275 inch pounds in sequence shown.

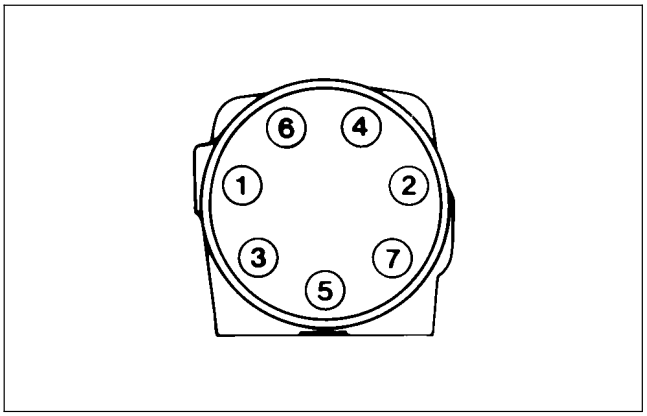


Figure 67

Chapter 5

Electrical System

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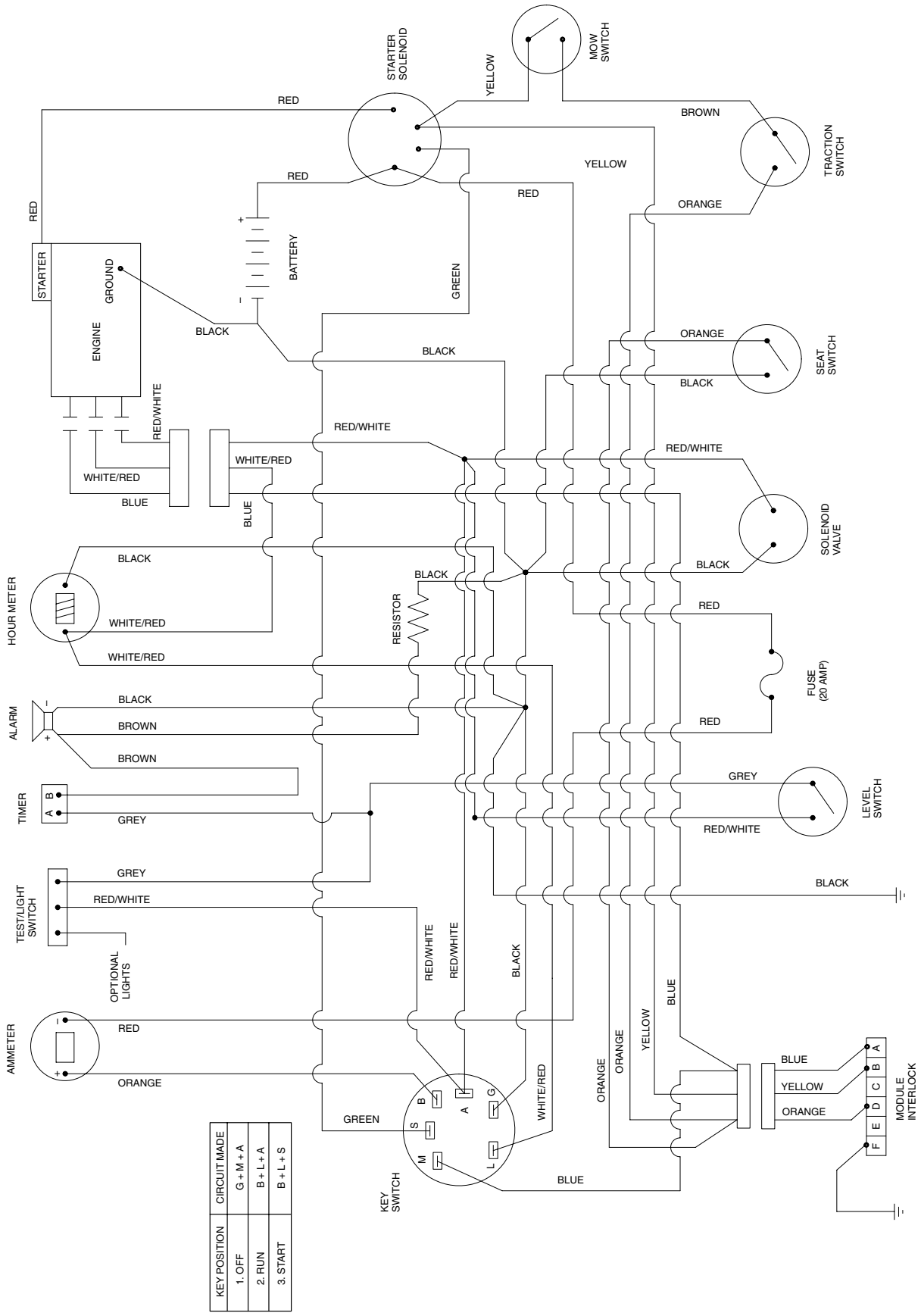
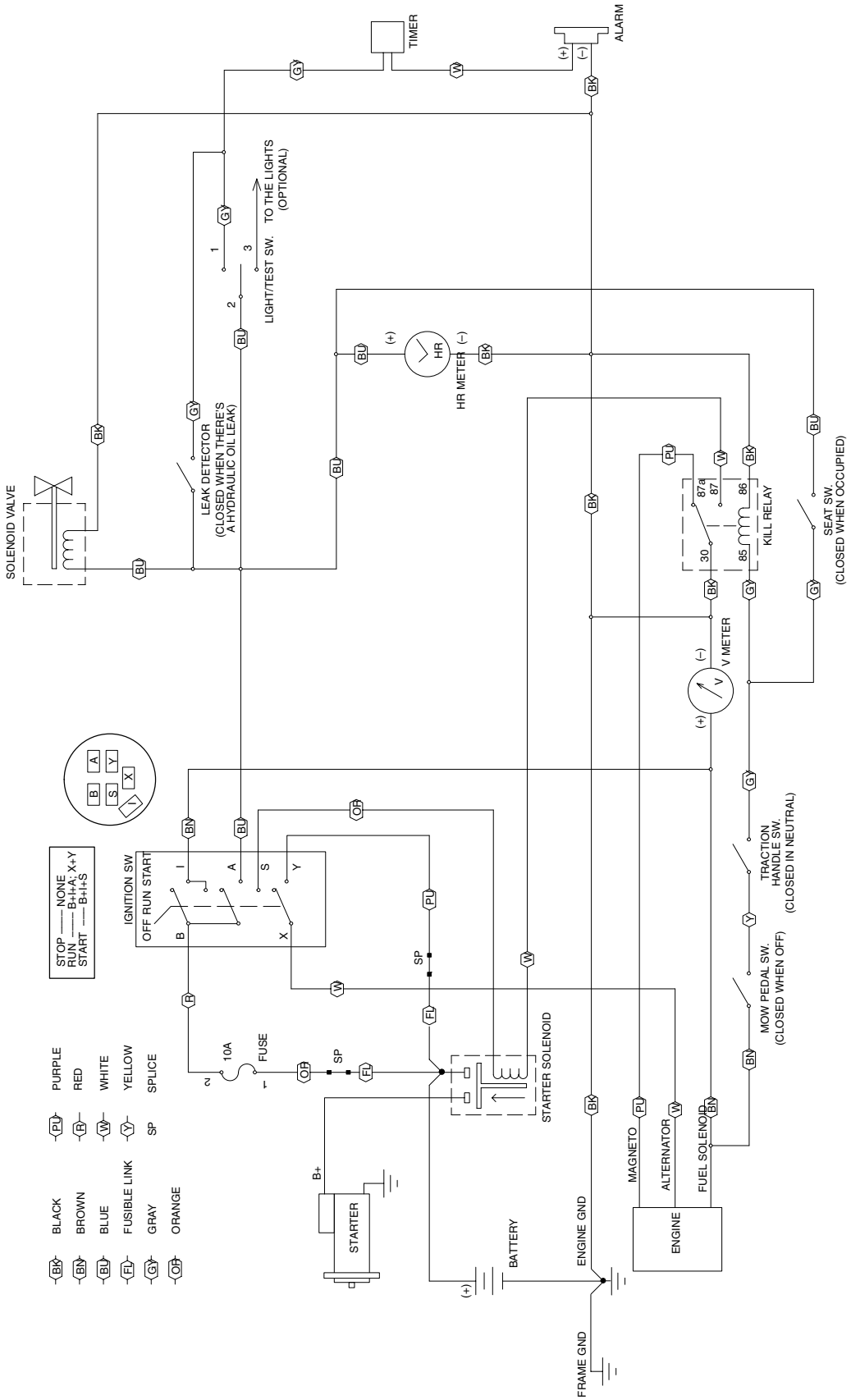
See **Chapter 3 - Engine** for information about the engine electrical system and components.

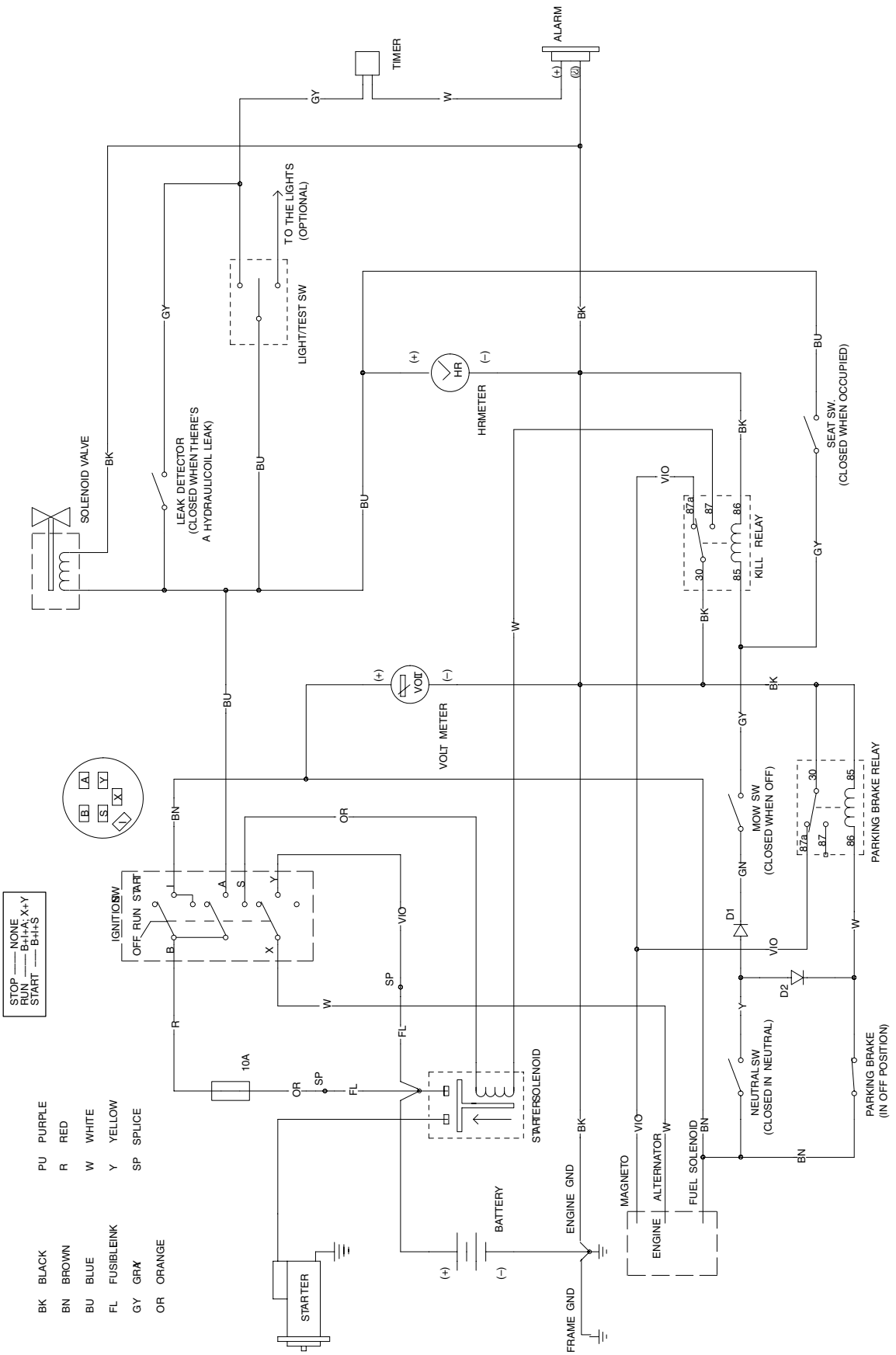
Wiring Schematic (Greensmaster 3100, S/N Below 80000)



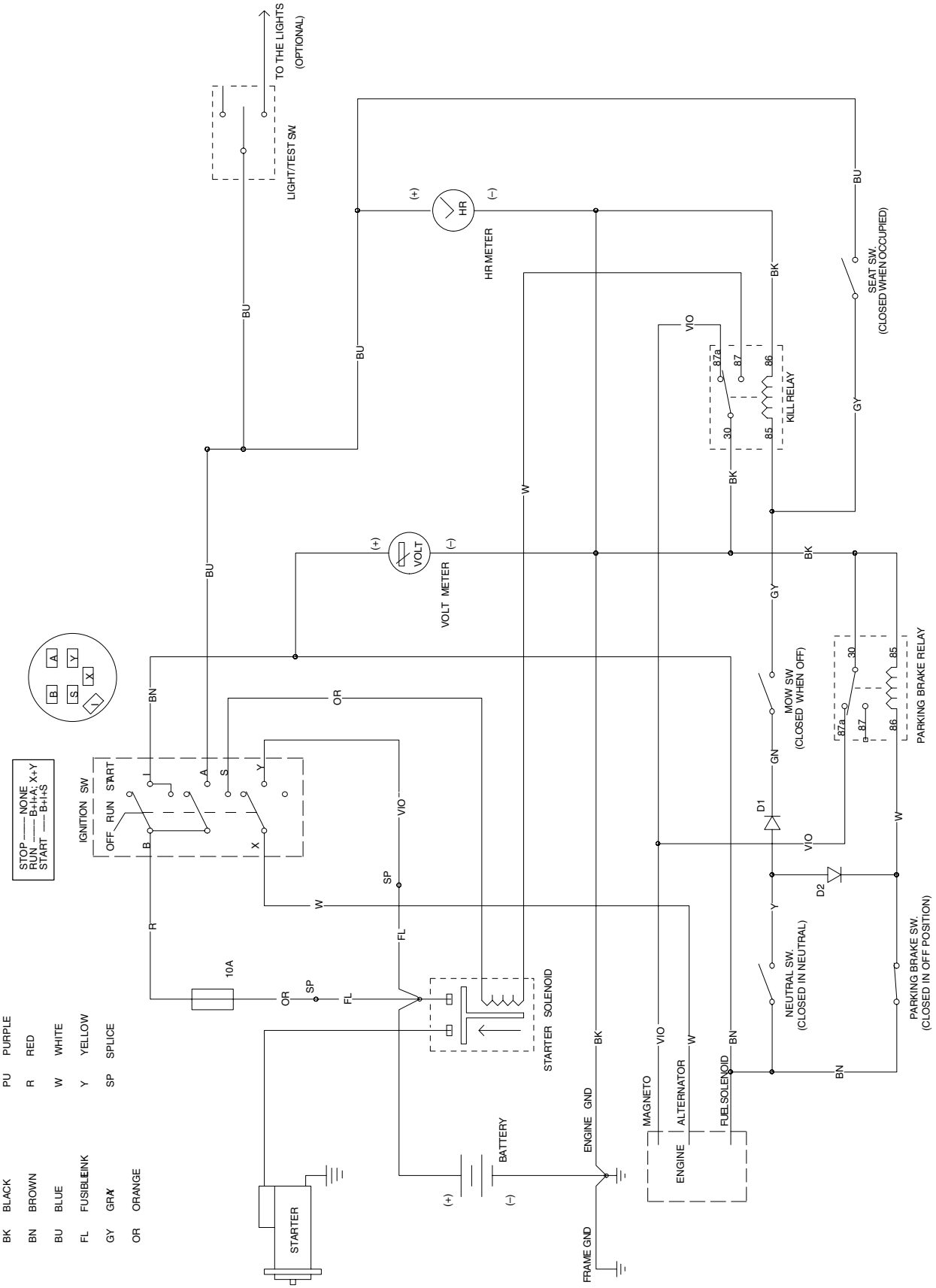
Wiring Schematic (Greensmaster 3100, S/N 80001 – 200999999)



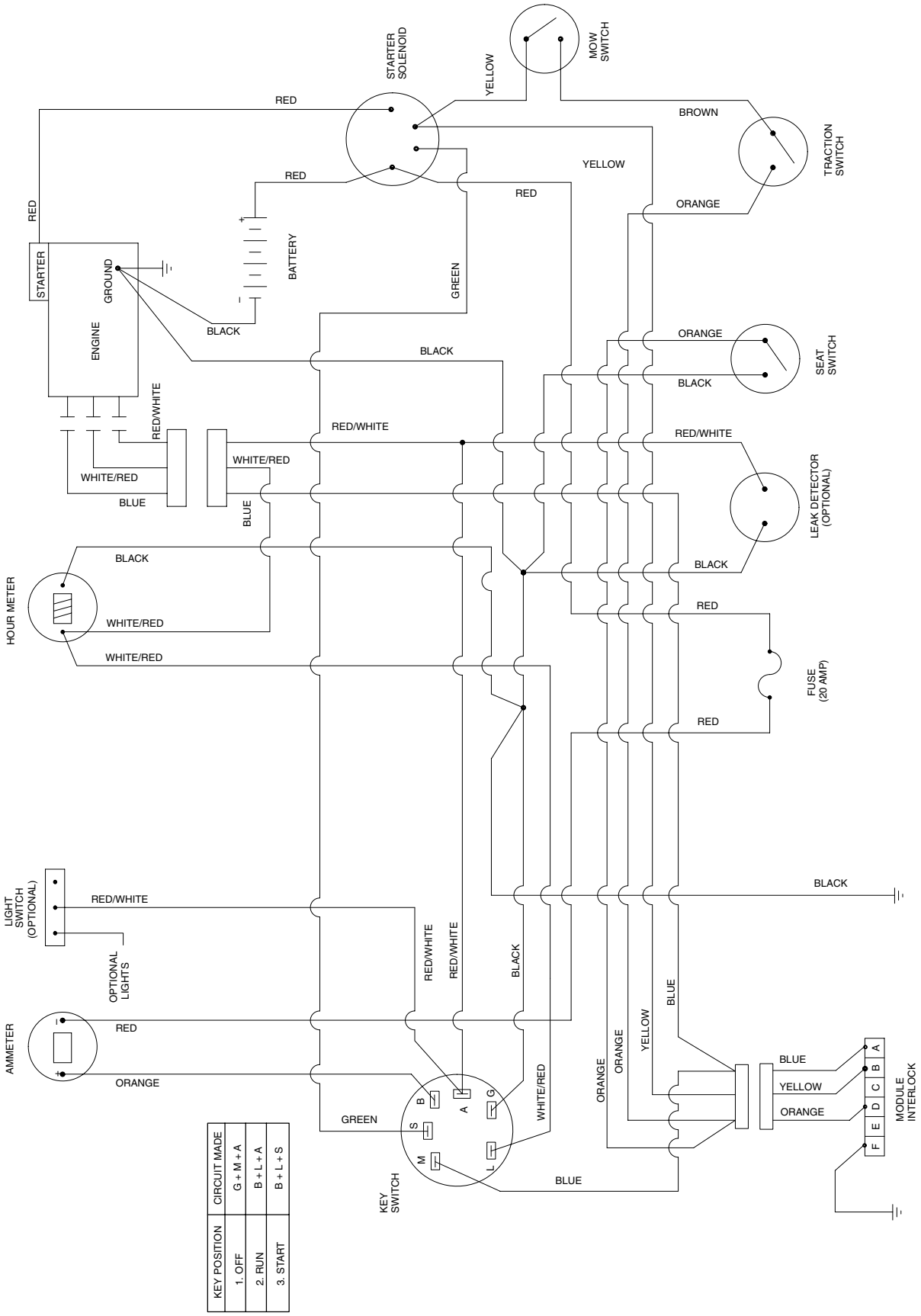
Wiring Schematic (Greensmaster 3100, S/N 210000001 – 220999999)



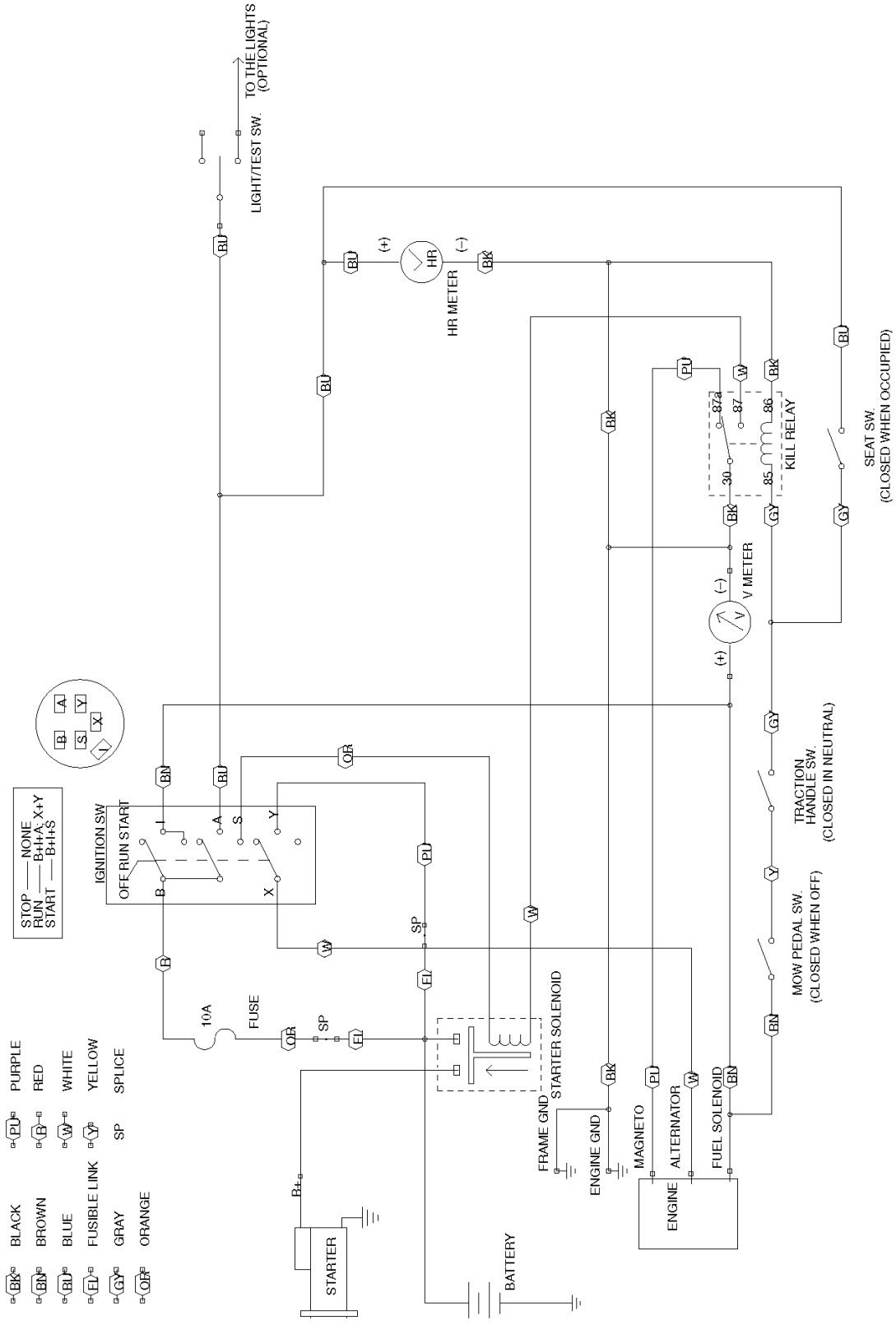
Wiring Schematic (Greensmaster 3100, S/N 230000001 and Up)



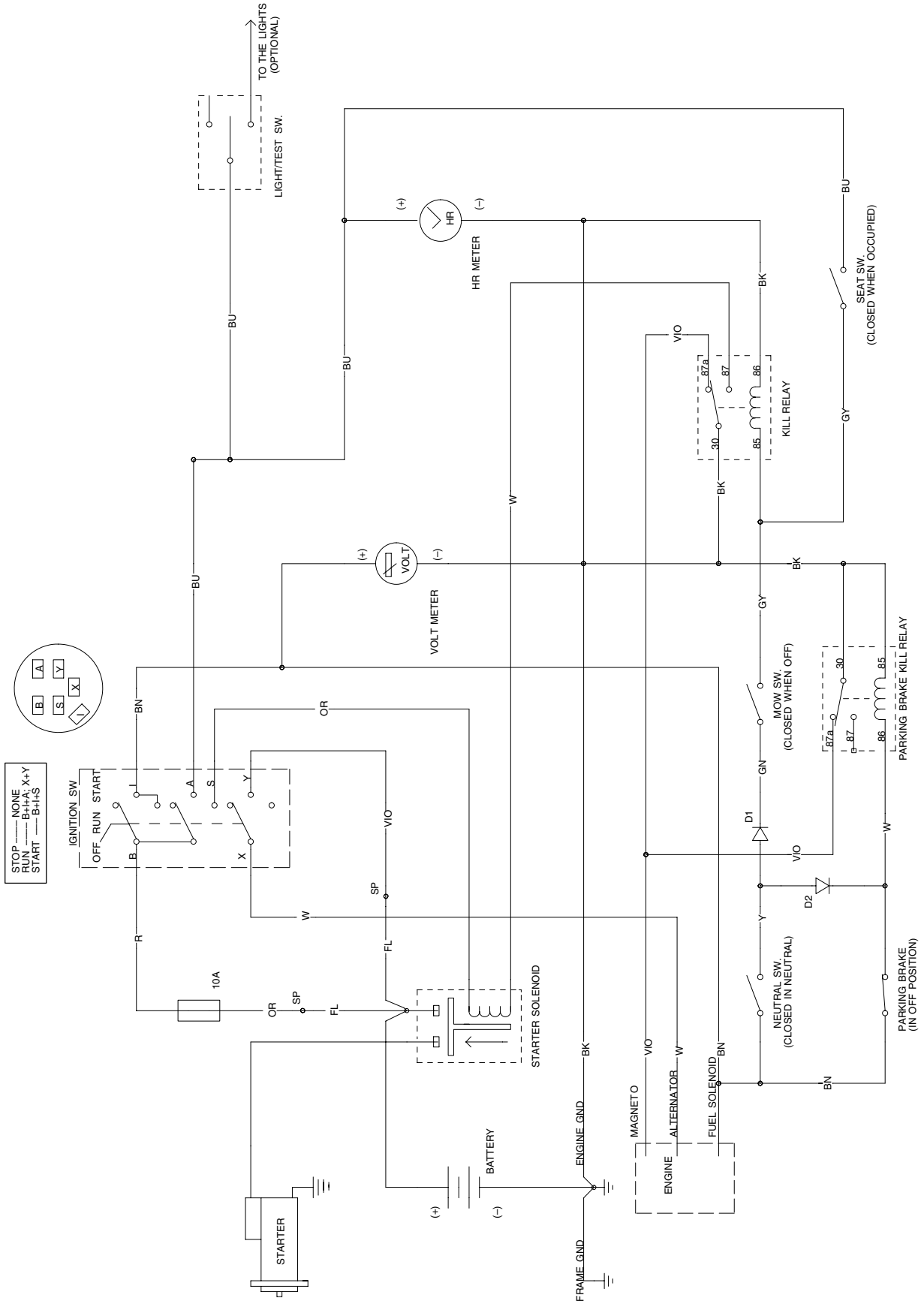
Wiring Schematic (Greensmaster 3050, S/N Below 80000)



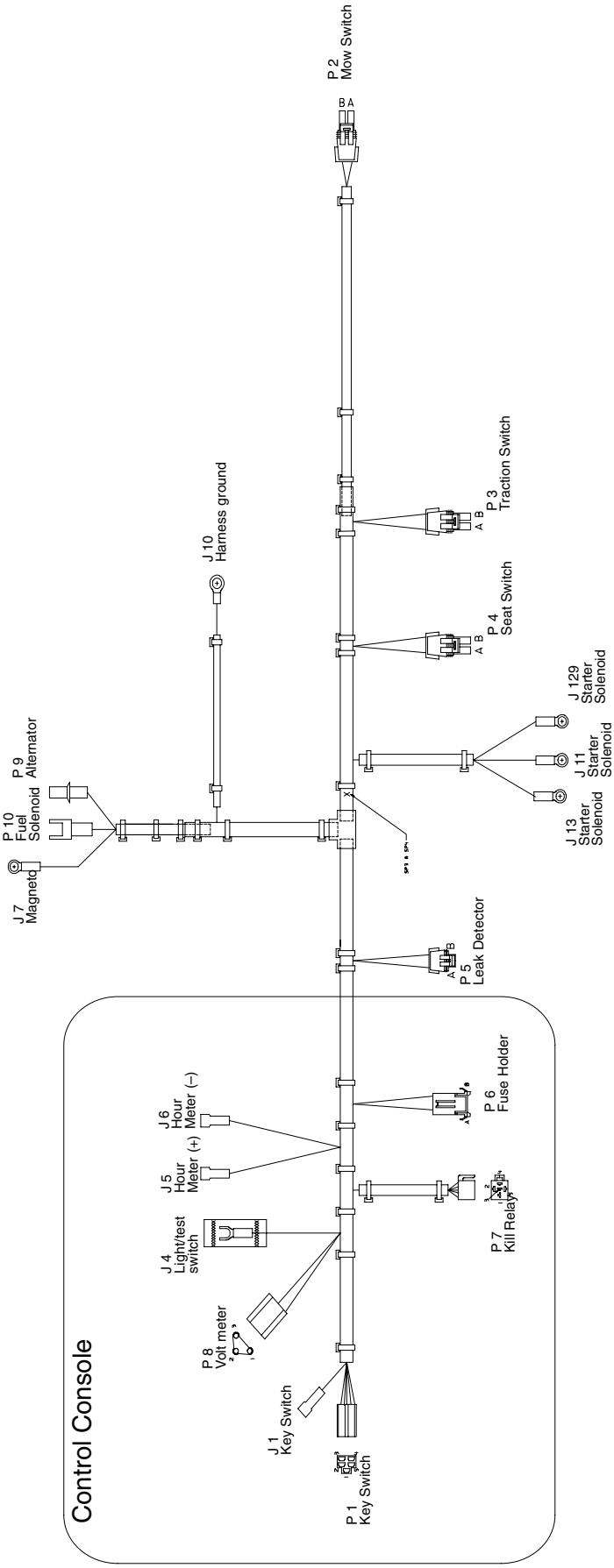
Wiring Schematic (Greensmaster 3050, S/N 80001 – 200999999)



Wiring Schematic (Greensmaster 3050, S/N 230000001 and Up)



Wiring Harness (Greensmaster 3100/3050, S/N 80001 – 200999999)



P 1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P 10
Key Switch Connector	Mow Switch Connector	Traction Switch Connectb	Seat Switch Connector	Leak detector Connector	Fuse Holder 10 Amp	Engine Kill Relay	Volt Meter Connector	Alternator Connector	Fuel Solenoid Connector
Located under Control console LH side of machine	Located on front LH side of Hydraulic valve	Located on rear RH side of Hydraulic valve	Located under operators seat	Located at center of machine, behind seat.	Located under control console	Located Under Control console	Located under control console	Located on back of engine	Located on back of engine
Cavity Wire 1 White 2 Violet 3 LT Blue & Blue 4 Red 5 Orange	Cavity Wire A Brown B Yellow	Cavity Wire A Yellow B Gray	Cavity Wire A Blue B Gray	Cavity Wire A Blue B Black	Cavity Wire A Red B Orange	Cavity Wire 1 Black 2 Gray 3 Violet 4 White 5 Black	Cavity Wire 1 Brown 2 Black 3 Open	Wire Color White	Wire Color Brown

J 1	J 4	J 5	J 6	J 7	J 10	J 11	J 12	J 13
Key switch Connector	Test Switch Connector	Hour Meter (+)	Hour Meter (–)	Magneto Connector	Engine Ground Connector	Starter Solenoid	Starter Solenoid Connector	Starter solenoid Connector
Located under Control console LH side of machine	Located under control console	Located under control console	Located under control console	Located on back of engine	Located front side of engine block	Located at center of machine, behind seat	Located center of the machine Behind operators seat	Located at center of machine, behind seat.
Wire Color Brown	Wire Color Blue LT/blue	Wire Color Blue Blue	Wire Color Black	Wire Color Violet	Cavity Wire A Black	Wire Color Orange	Wire Color Orange	Wire Color White

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Turf Guardian™ Leak Detection System (Greensmaster 3100 S/N below 230000001)

Before Start-Up (Cold Oil)

With ignition switch off, solenoid valve is open. Before start-up, hydraulic fluid is at level mark of sight gauge (oil cold). Float is in raised position, keeping alarm circuit open.

To check alarm and delay timer, turn ignition switch to ON, then move leak detector switch rearward and hold. After a one second time delay alarm should sound.

To check leak detector float switch, remove hydraulic tank cap and strainer from neck of tank. Turn ignition switch to ON (DO NOT start engine). Insert a clean rod or screw driver into tank neck and gently push down on switch float. Alarm should sound after a one second time delay.

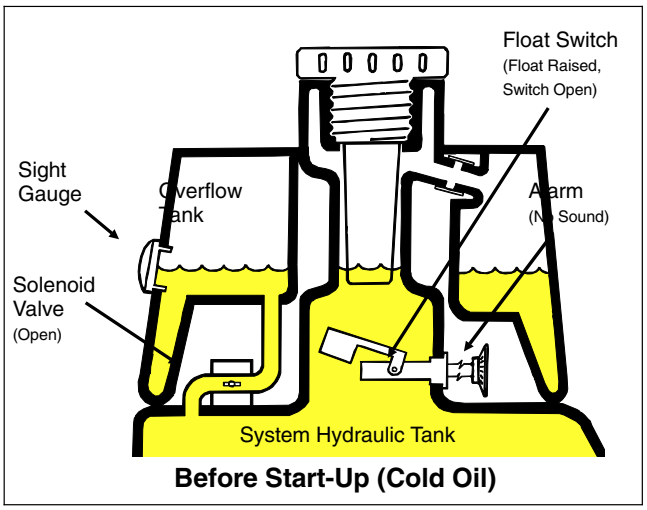


Figure 2

Normal Operation (Warm Oil)

When key switch is turned on, solenoid valve closes. During normal operation, hydraulic fluid expands, causing it to flow into overflow tank. Float stays in raised position, keeping alarm circuit open.

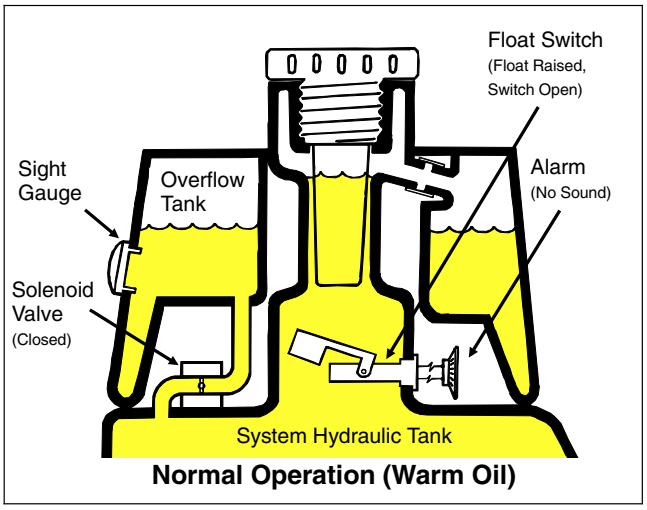


Figure 3

Leak Alert !

If oil leaks during operation, fluid level drops in system hydraulic tank. This causes float to lower, closing alarm circuit. After a one second delay alarm will sound.

NOTE: During normal operation, with cutting units lowered, approximately 5 oz. of oil will leak before float switch activates alarm.

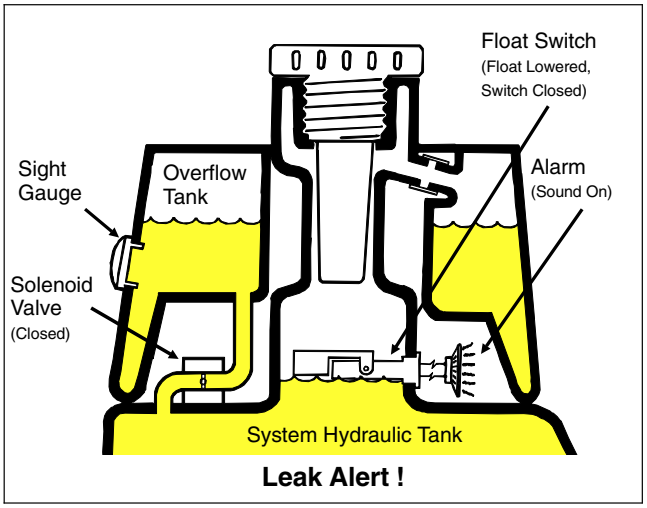


Figure 4

Special Tools

NOTE: Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*. Some tools may be available from a local supplier.

Continuity Tester (Fig. 5)

Battery powered test lamp which is helpful in testing for continuity of circuits and electrical components when the current is off.

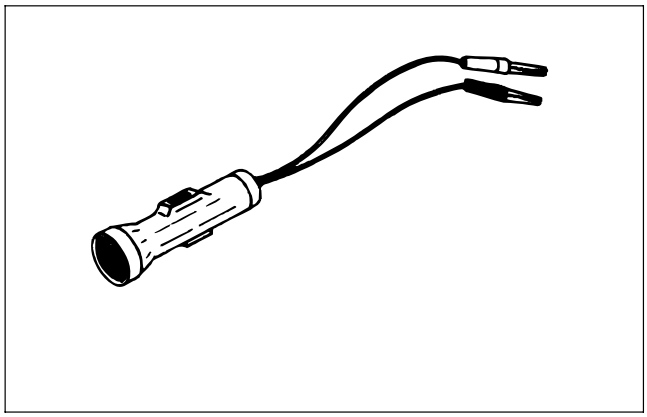


Figure 5

Volt - Ohm - Amp Meter (Fig. 6)

The meter can test electrical components and circuits for current, resistance, or voltage draw.

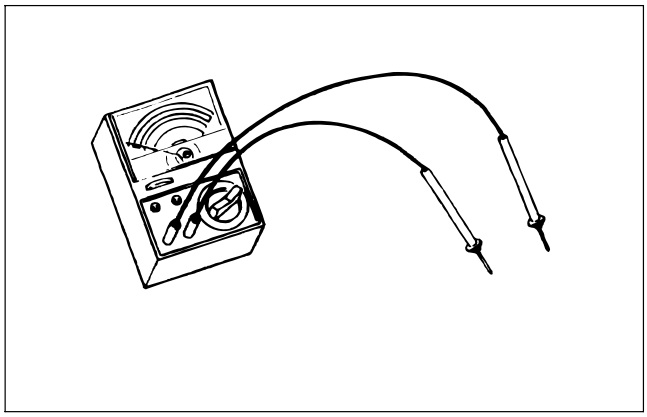


Figure 6

Skin-Over Grease (Fig. 7)

Special non-conductive grease which forms a light protective skin to help waterproof electrical switches and contacts. Recommended for all interlock system connections.

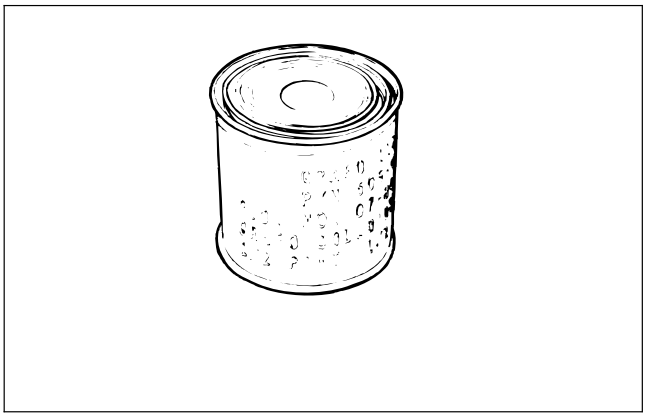


Figure 7

Troubleshooting

CAUTION

Remove all jewelry, especially rings and watches, before doing any electrical troubleshooting. Disconnect battery cables unless the test requires battery voltage.

For effective troubleshooting and repairs, you must have a good understanding of the electrical circuits and components used. Tools such as a volt/ohm multimeter will help find problems in the circuitry.

Studying the operating characteristics preceding an electrical failure will help in identifying the area of difficulty. Try to isolate the failure to a specific functional system; then check that area, repairing one component at a time. Attempting to repair two systems at once will lead to confusion.

NOTE: The interlock switches are described as normally open (NO) or normally closed (NC). The NC-NO description indicates the switch contact position with the switch installed in the machine with MOW OFF, TRANSMISSION in NEUTRAL, and OPERATOR OFF of seat. Should the machine being repaired have these components by-passed, they should be reconnected for proper troubleshooting and safety.

Condition	Cause	Correction
1. Engine starts (but should not) when shift selector is in gear.	Traction switch adjusted incorrectly or is malfunctioning.	Adjust or replace traction switch.
2. Engine starts (but should not) when mow pedal is depressed (reels engaged).	Mow/lift switch adjusted incorrectly or is malfunctioning.	Adjust or replace mow/lift switch.
3. Engine fails to crank, regardless of shift selector or mow pedal position.	Mow/lift switch and/or traction switch out of adjustment or malfunctioning.	Adjust or replace traction switch and/or mow/lift switch.
	Loose or corroded battery connections.	Clean and tighten connections.
	Mow/lift switch or traction switch wires are loose.	Check wires and connect properly.
	Battery is dead.	Charge or replace battery.
	Starter solenoid is malfunctioning.	Replace solenoid.
	Ignition switch is malfunctioning.	Replace ignition switch.
	Starter is malfunctioning.	Replace or repair starter.
	Engine is seized.	Repair engine.
	Key switch, ammeter or solenoid wires loose.	Connect wires.
4. Engine fails to crank with controls in “neutral” when operator is off seat, but does crank when operator is on seat.	Wiring harness connected wrong.	Connect wiring harness correctly: refer to Electrical Schematic.
	Wiring harness malfunctioning.	Install new wiring harness.

Problem	Cause	Correction
5. Engine cranks but does not start when shift selector and mow pedal are in neutral.	If engine cranks, cause of problem is UNRELATED to interlock wiring system.	All interlock switches are OK; refer to next cause.
	Engine or rectifier plug loose.	Connect wire.
	Key switch wiring connector loose.	Connect wire
	Engine problem or no fuel.	Find problem and correct.
6. Engine does not stop when mow pedal is pushed down (cutting units engaged) as you get off of the seat.	Mow/lift switch or seat switch out of adjustment or malfunctioning.	Adjust or replace mow/lift switch or seat switch.
	Rear camshaft out of adjustment.	Adjust rear camshaft.
	Seat return pin spring broken, missing or stuck in down position.	Replace, loosen and lubricate parts so pin operates freely.
	Seat pivot does not rotate freely.	Loosen and lubricate seat pivot pin to make sure if pivots freely.
7. Engine does not stop when shift selector is in No. 1 or No. 2 position as you get off of the seat.	Traction switch or seat switch out of adjustment or malfunctioning.	Adjust or replace traction switch or seat switch.
	Seat return pin spring broken, missing or stuck in down position.	Replace, loosen and lubricate parts so pin operates freely.
	Seat pivot does not rotate freely.	Loosen and lubricate seat pivot pin to make sure if pivots freely.
8. Engine does not continue to run when sitting on seat and shift selector is placed in No.1 or No.2 position or mow pedal is pushed down.	Seat switch adjusted incorrectly or malfunctioning.	Adjust or replace seat switch.
	Seat return spring jammed in up position.	Loosen and lubricate jammed parts so pin operates freely. Replace spring if necessary.
9. Engine stops regardless of shift selector or mow pedal position (even if both are in “neutral”) as you get off of the seat.	Mow/lift switch and/or traction switch out of adjustment or malfunctioning.	Adjust or replace mow/lift switch and/or traction switch.
	Rear camshaft out of adjustment.	Adjust rear camshaft.
	Mow/lift and/or traction switch wires are loose.	Connect wires.
	Traction switch extension plug wires are loose.	Connect wires.
10. Engine seems to “cut-out” too much during transport.	Seat is lifting off seat switch button too easily.	Adjust seat switch. Instruct operator to sit back in seat during transport.

Problem	Cause	Correction
11. Engine does not stop when ignition key is rotated to OFF position.	Loose wire(s) in electrical system.	Check all connections and repair as necessary.
	Ignition switch is malfunctioning.	Replace ignition switch.
	Engine timing or carburetor out of adjustment.	Adjust carburetor or engine timing.
12. Battery does not charge.	Open or missing fuse.	Install new fuse.
	Loose wire(s) in electrical system.	Check all connections and make all necessary repairs.
	Malfunctioning regulator or engine charging circuit.	Install new regulator or repair engine charging circuit.
	Faulty battery.	Test and replace if necessary.

Verify Interlock Operation

The interlock system is designed to stop the engine when the operator is off of the seat, while the traction selector is in the No. 1 or No. 2 position or the mow pedal is pushed down. The system also prevents the engine from starting in the same situation.

CAUTION

Do not disconnect or bypass the interlock switches. Check the operation of the switches to assure that the interlock system is operating correctly. If a switch is malfunctioning or out of adjustment, adjust or replace it before operating the machine. To assure maximum safety, replace all interlock switches every two years or 1000 hours, whichever comes first.

To check the operation of the interlock switches:

1. Set on the seat and engage the parking brake. Push the lift pedal down all the way and release it. Move the shift selector to the No. 1 position and try to start the engine. The engine should not crank. Move the shift selector to the No. 2 position and try to start the engine. The engine should not crank. If the engine did not crank in either position, the traction switch is operating properly – proceed to step 2. If the engine cranked, refer to Troubleshooting in this chapter.

2. Sit on the seat and engage the parking brake. Push the lift pedal down all the way and release it. Move the shift selector to the neutral (N) position and try to start the engine. The engine should start and continue to run, which means that the traction switch and mow/lift switch is operating correctly - proceed to step 3. If the engine cranked, but did not start, the problem is not in the interlock system. If the engine did not crank, refer to Troubleshooting in this chapter.

3. Sit on the seat and engine the parking brake. Move the shift selector to the neutral (N) position. Push the mow pedal down and try to start the engine. The engine should not crank, which means the mow/lift switch is operating correctly - proceed to step 4. If the engine cranked, refer to Troubleshooting in this chapter.

4. Sit on the seat and engage the parking brake. Move the shift selector to neutral (N). Push lift pedal down and release it. Start the engine, release the parking brake and drive the machine to an open area that is free of debris and foreign objects. Keep all people, especially children away from the front of the machine and out of the area of operation. Move shift selector to neutral (N), make sure the mow pedal is disengaged, set the throttle control at half speed and engage the parking brake. Hold the steering wheel, brace your feet on the foot deck and brake pedal, and move the shift selector to the No. 1 position. Carefully lift off the seat; the engine should stop. Repeat procedure with shift selector in No. 2 position. If engine stops while lifting off the seat with shift selector in No. 1 and No. 2 positions, interlock system is operating correctly. If engine does not stop, stop the engine and correct the problem before operating the machine. Refer to Troubleshooting in this chapter.

Testing

It is often to the technician's advantage to leave the components intact in the electrical system, and by studying the electrical troubleshooting charts and schematics, determine which component is at fault. However, this section will define given components, and the tests that can be performed on those components, when those parts are isolated from the electrical system.

For accurate resistance and/or continuity checks, electrically disconnect the component being tested from the circuit.

CAUTION

When testing electrical components with a volt-ohm meter or continuity tester, make sure that power to the circuit has been disconnected.

Ignition Key Switch (Fig. 8)

The ignition (key) switch has three positions (OFF, START and RUN). The terminals are marked as shown.

The circuitry of the ignition switch is shown in the charts. With the use of a continuity tester, the switch functions may be tested to determine whether all circuits are being completed while the key is moved to each position.

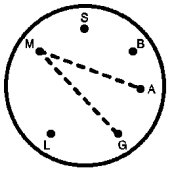
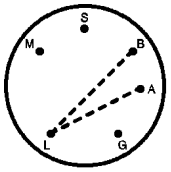
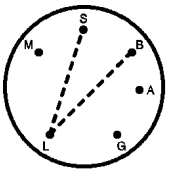
POSITION	CONTINUITY AMONG TERMINALS	
1. OFF		G + M + A
2. RUN		B + L + A
3. START		B + L + S

Figure 8

Seat Switch (Fig. 9)

1. Disconnect the seat switch wire connector and install a continuity tester or ohm meter between the two leads of the seat switch.

2. Lower the seat. The continuity tester should show no continuity.

3. Have the operator sit on the seat, slowly depressing the seat switch. The continuity tester should indicate a reading as the seat approaches the bottom of its travel.

NOTE: Make sure the compression spring and pin hold the seat up off the seat switch when there is on operator on the seat.

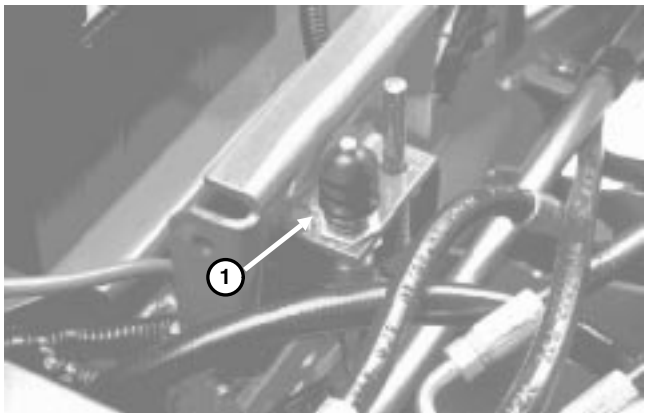


Figure 9

1. Seat switch

Traction (Neutral) Switch (Fig. 10)

1. Disconnect the traction switch wire connector and install a continuity tester or ohm meter between the two leads of the traction switch.

2. Make sure the shift selector is in the neutral (N) position. There should be continuity when the shift selector is in the neutral (N) position. If there is no continuity adjust or replace the switch. (See Traction (Neutral) Switch Replacement and Adjustment in the Repairs section of this book.)

3. Move the shift selector to the No.1 and No. 2 positions. There should not continuity when shift selector is in either of these positions. If there is continuity adjust or replace the switch. (See Traction (Neutral) Switch Replacement and Adjustment in the Repairs section of this book.)

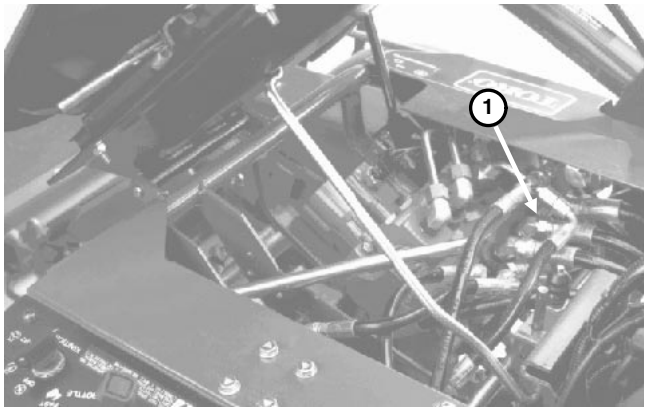


Figure 10

1. Traction (neutral) switch (on bottom of valve bank)

Mow/Lift Switch (Fig. 11)

1. Disconnect the mow/lift switch wire connector and install a continuity tester or ohm meter between the two leads of the mow/lift switch.

2. Push down on the lift pedal and release it. There should be continuity when the mow pedal is disengaged. If there is no continuity, adjust or replace the switch. (See Mow/Lift Switch Replacement and Adjustment in the Repairs section of this book.)

3. Push down on the mow pedal and release it. There should not be continuity. If there is continuity, adjust or replace the mow/lift switch. (See Mow/Lift Switch Replacement and Adjustment in the Repairs section of this book.)

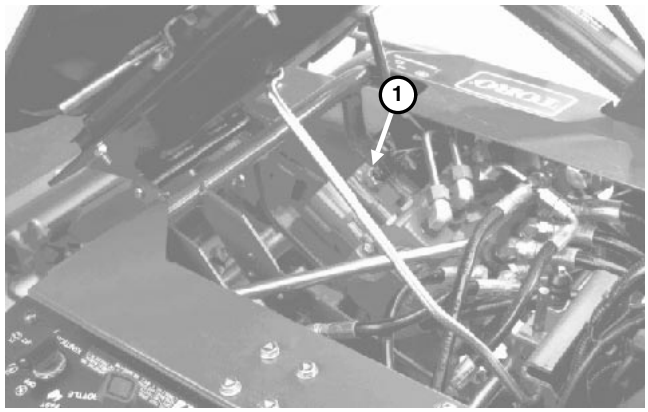


Figure 11

1. Mow/lift switch

Interlock Module (Fig. 12)

The interlock module (Item 26) senses the condition of the seat switch, traction switch, and mow/lift switch. The seat switch must remain CLOSED while the traction switch or mow/lift switch is OPEN for the ignition system to operate.

The “closed to operate” requirement of the interlock module makes sure that the engine will not run if switch leads are broken or become disconnected.

Because of the solid-state circuitry built into the interlock module, there is no direct method to test it. The module may be damaged if an attempt is made to test it with an electrical test device such as a volt-ohm meter.

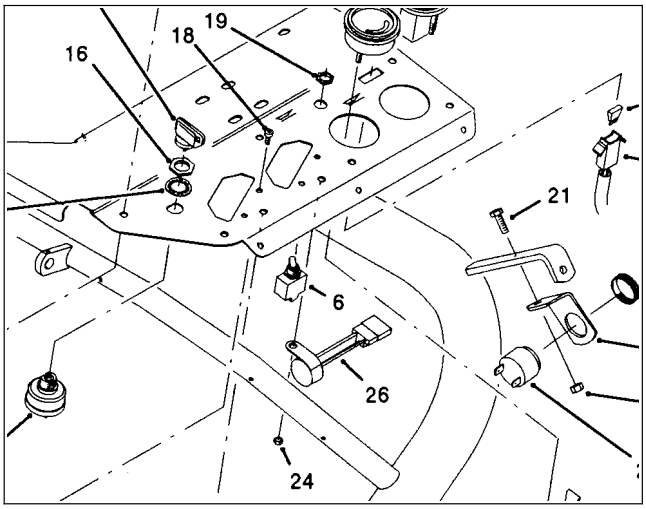


Figure 12

Battery

Terminal Voltage Test

1. Use a volt-ohm meter to measure the voltage between the battery terminals.

2. If the voltage is less than 12.3 V.D.C., the battery should be charged.

Hourmeter

Test the hourmeter by disconnecting the wires and applying 12 V.D.C. between the terminals.

Turf Guardian™ Leak Detector System

Alarm and Delay Timer (Fig. 13)

To test alarm (Item 25)) and delay timer (Item 27), turn ignition switch to ON, then move leak detector switch (Item 6) rearward and hold. After a one second time delay alarm should sound.

Float Switch (Fig. 14)

To test leak detector float switch (Item 3) when connected to circuit, remove hydraulic tank cap and strainer from neck of tank. Turn ignition switch to ON (DO NOT start engine). Insert a clean rod or screw driver into tank neck and gently push down on switch float. Alarm should sound after a one second time delay.

To test switch when isolated from circuit, disconnect wiring harness connector at float switch. Connect continuity tester across wiring terminals of float switch. Switch should show continuity when float is pushed down. Switch should show no continuity when float is in raised position.

Solenoid Valve (Fig. 14)

1. Disconnect wiring connector at solenoid valve (Item 28).

2. Connect a 12 volt battery so positive (+) battery terminal is connected to one one lead of connector and negative (–) is connected to other lead. The valve spool should retract completely as 12 V.D.C. is applied between the leads.

3. Iv valve operates smoothly, but does not retract when 12 V.D.C. is applied so solenoid leads, replace solenoid valve.

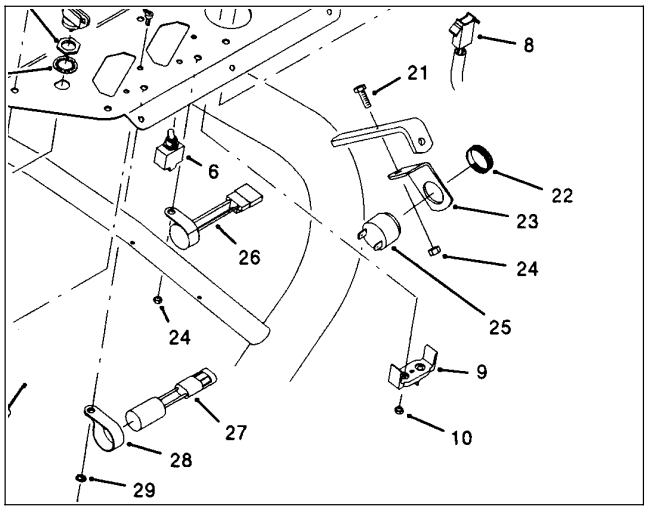


Figure 13

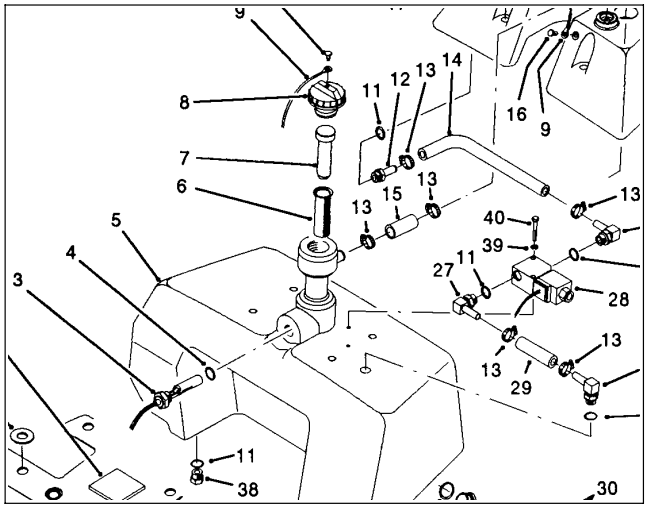


Figure 14

General Safety Interlock Switch Service

The following procedures should be followed whenever a switch requires adjustment or replacement:

1. Be sure rubber boot is reinstalled in both switch grooves on the button end of seat switch after it is properly adjusted.

IMPORTANT: Rubber boot on button end must be in place to make sure all dirt, moisture and grease are kept from the plunger sides.

2. Spread Skin-Over grease heavily over the terminal end and inside the terminal cover of all switches before installing the connectors and terminal cover. Be sure the wires are fully connected.

3. Make sure terminal cover is fully installed over end of switch.

Seat Switch Replacement and Adjustment (Fig. 15)

1. Pivot seat forward and block or tie it securely to prevent it from falling accidentally and possibly causing injury.

2. Remove boot from button end of seat switch and retain for installation on replacement switch. Pull connectors off switch terminals.

3. Loosen the jam nut and unscrew the switch from mounting bracket.

4. Screw new switch through mounting bracket until switch button is about 1/16 inch (1.6 mm) shorter than the top of the seat return spring pin. Install the boot into the mount grooves.

5. Carefully release the seat to its normally down position, but do not sit or apply force on the seat. There should be a slight gap between the switch and the seat plate.

6. Make sure switch terminals face front of machine and lock switch in place by tightening the jam nut to 75 in.-lb (8.5 Nm) against the mounting bracket.

IMPORTANT: Switch threads will be damaged if the jam nut is over-tightened.

7. Connect continuity tester of ohm meter to switch terminals. With seat in the down position and no one on the seat, the switch circuit should not have continuity. If there is continuity, repeat steps 4-6. If there is no continuity, proceed to

8. Sit on the seat. The seat switch should have continuity. If there is no continuity, repeat steps 4-7. If there is continuity proceed to step 9.

9. Fill terminal end of switch and wiring harness cover with skin-over grease and push connectors onto switch terminals. Be sure connectors are fully connected and slide cover over bottom of switch body.

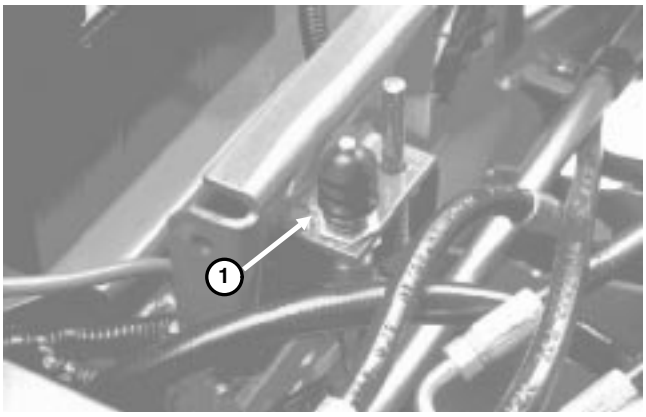


Figure 15

1. Seat switch

Traction (Neutral) Switch Replacement and Adjustment (Fig. 16)

1. Pull connector off switch terminals of traction switch installed in valve bank bonnet on selector valve section.

2. Loosen the jam nut and unscrew the switch from the mounting bracket.

3. Move shift selector to Neutral.

4. Partially screw new switch into bonnet.

5. Connect a continuity tester or ohm meter to the switch terminals and continue to turn the switch in until there is continuity. Then rotate switch in 1/2 turn (180°).

6. Secure jam nut to 75 in.-lb (8.5 Nm) against the bonnet.

IMPORTANT: Switch threads will be damaged if the jam nut is over-tightened.

7. Connect continuity tester or ohm meter to switch terminals and move shift selector to the No. 1 and No. 2 positions. There should not be continuity when shift selector is in either of these positions. If there is continuity, repeat steps 4 and 5.

8. Move the shift selector lever to Neutral and connect continuity tester or ohm meter to switch terminals. The switch should show continuity. This means the switch is operating correctly.

9. Fill terminal end of switch and wiring harness cover with skin-over grease and push connectors onto switch terminals.

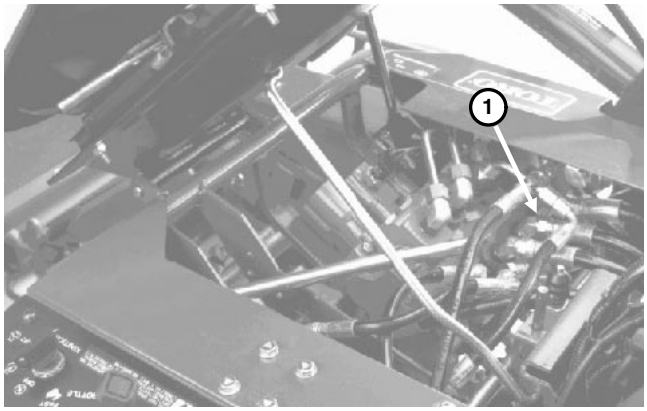


Figure 16

1. Traction switch

Mow/Lift Switch Replacement and Adjustment (Fig. 17)

IMPORTANT: Spool travel for 1, 2 and 3 spools must be correct before Mow/Lift switch can be adjusted. (See Rear Camshaft Adjustment in the Adjustments section of Chapter 4 - Hydraulic System.)

1. Pull connector off switch terminals from end of mow/lift switch installed in the valve bank bonnet.

2. Loosen jam nut and unscrew switch from valve bank bonnet.

3. While holding lift pedal in fully depressed position (valve bank spools fully IN) partially screw new switch into bonnet.

4. Connect continuity tester on ohm meter across switch terminals and turn switch in until continuity occurs. Then rotate switch in 1/2 turn (180) and secure jam nut to 75 in.-lb. (8.5 Nm) against the bonnet.

IMPORTANT: Switch threads will be damaged if the jam nut is over-tightened.

5. Connect continuity tester or ohm meter to switch terminals and depress the mow pedal. There should not be continuity. If there is continuity, repeat step 3. Proceed to step 6 if there is no continuity.

6. Depress the lift pedal and release it (neutral position). The switch circuit should have continuity.

7. Fill terminal end of switch and wiring harness cover with skin-over grease and push connectors onto switch terminals.

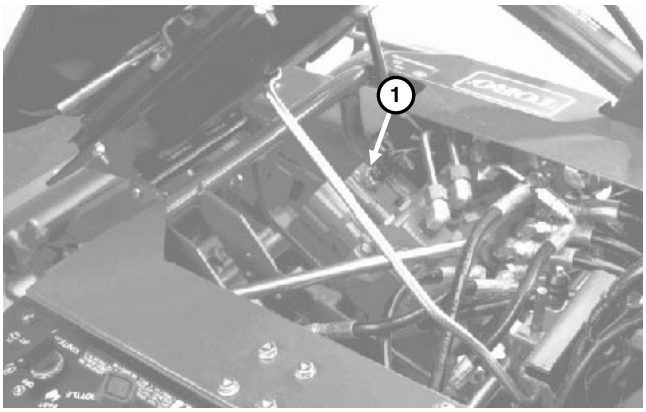


Figure 17

1. Mow/lift switch

Wiring Harness Service

Prevent corrosion of the wiring terminals by applying skin-over grease to the inside of all harness connectors whenever the harness is disconnected.

Always disconnect the battery cables, negative (–) cable first, to prevent possible wiring damage from short-outs whenever working with the electrical system.

Battery Service (Fig. 18, 19)

IMPORTANT: Before welding on the machine, disconnect the negative (–) battery cable from the battery to prevent damage to the electrical system.

IMPORTANT: To prevent damage to the electrical components, do not operate the engine with the battery cables disconnected.

Keep the terminals and entire battery case clean. To clean the battery, wash the entire case with a solution of baking soda and water. Rinse with clear water. Do not get the soda solution into the battery because damage to the battery will result. Coat the battery posts and cable connectors with skin-over grease, or petroleum jelly to prevent corrosion.

Check for loose battery hold-downs. A loose battery may crack or cause the container to wear and leak acid.

Check the electrolyte solution to make sure the level is above the plates. If the level is low (but above the plates inside the battery), add water so the level is to the bottom of the cap tubes. If the level is below the plates, add water only until the plates are covered and then charge the battery. After charging, fill the battery to the proper level.

Electrolyte Specific Gravity

Fully charged: 1.250 - 1.280
Discharged: less than 1.240

WARNING

Do not charge a frozen battery because it can explode and cause injury. Let the battery warm to 60° F (15.5° C) before connecting to a charger.

Charge the battery in a well-ventilated place so that gases produced while charging can dissipate. Since the gases are explosive, keep open flame and electrical spark away from the battery; do not smoke. Nausea may result if the gases are inhaled. Unplug the charger from the electrical outlet before connecting or disconnecting the charger leads from the battery posts.

Battery Specifications

BCI Group U1 Battery
200 Amp Cranking Performance at 0° F (17 ° C)
32 min. Reserve Capacity at 80° F (27 ° C)

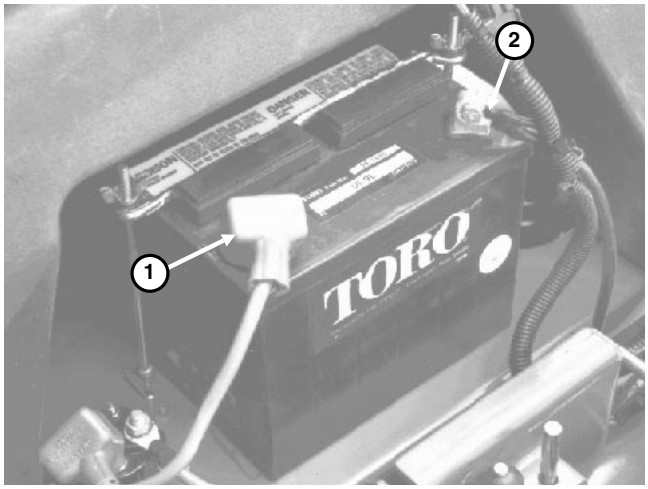


Figure 18

1. Positive (+) terminal
2. Negative (–) terminal

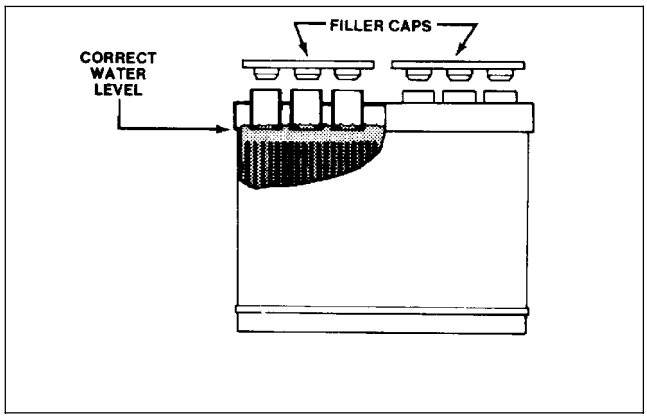


Figure 19

Chapter 6

Wheels, Steering and Brakes

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See **Chapter 4 - Hydraulic System** for information about the power steering system.

Specifications

Item	Specification
Tire pressure	8 - 12 PSI front 8 - 15 PSI rear
Wheel nut torque	40 - 50 ft-lb
Wheel motor spindle nut torque	250 - 400 ft-lb

Adjustments

Brake Adjustment (Fig. 1)

A brake adjustment rod is located on each side of the machine so the brakes can be equally adjusted.

1. Push down on the brake pedal while driving the machine; both wheels should lock equally.

CAUTION

As a safety precaution, always check brakes in a wide, open spaced, flat area which is free of other persons and obstructions before and after adjustment.

2. If both wheel do not lock equally, disconnect the brake rods by removing cotter pin and clevis pin.

3. Loosen jam nut and adjust clevis.

4. Assemble clevis to brake shaft.

5. Check brake pedal free travel. There should be 1/2 in. to 1 in. travel before the brake shoes make contact with the brake drums. Adjust again, if necessary, to get this setting.

6. Push down on the brake pedal while driving the machine; both wheels should lock equally. Repeat steps 2 - 5 if necessary.

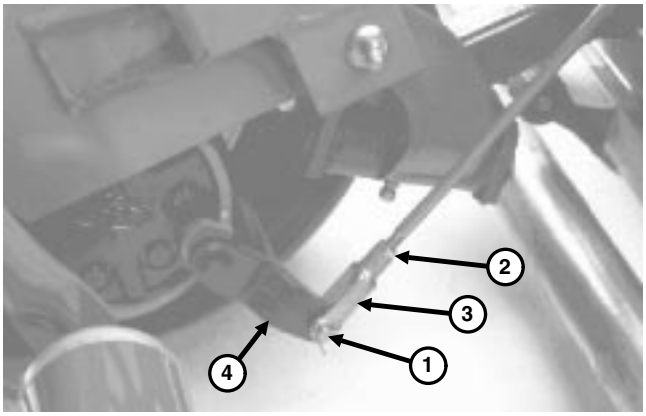

Figure 1

1. Clevis pin and cotter pin
2. Jam nut
3. Clevis
4. Brake shaft

Brake Service (Fig. 2)

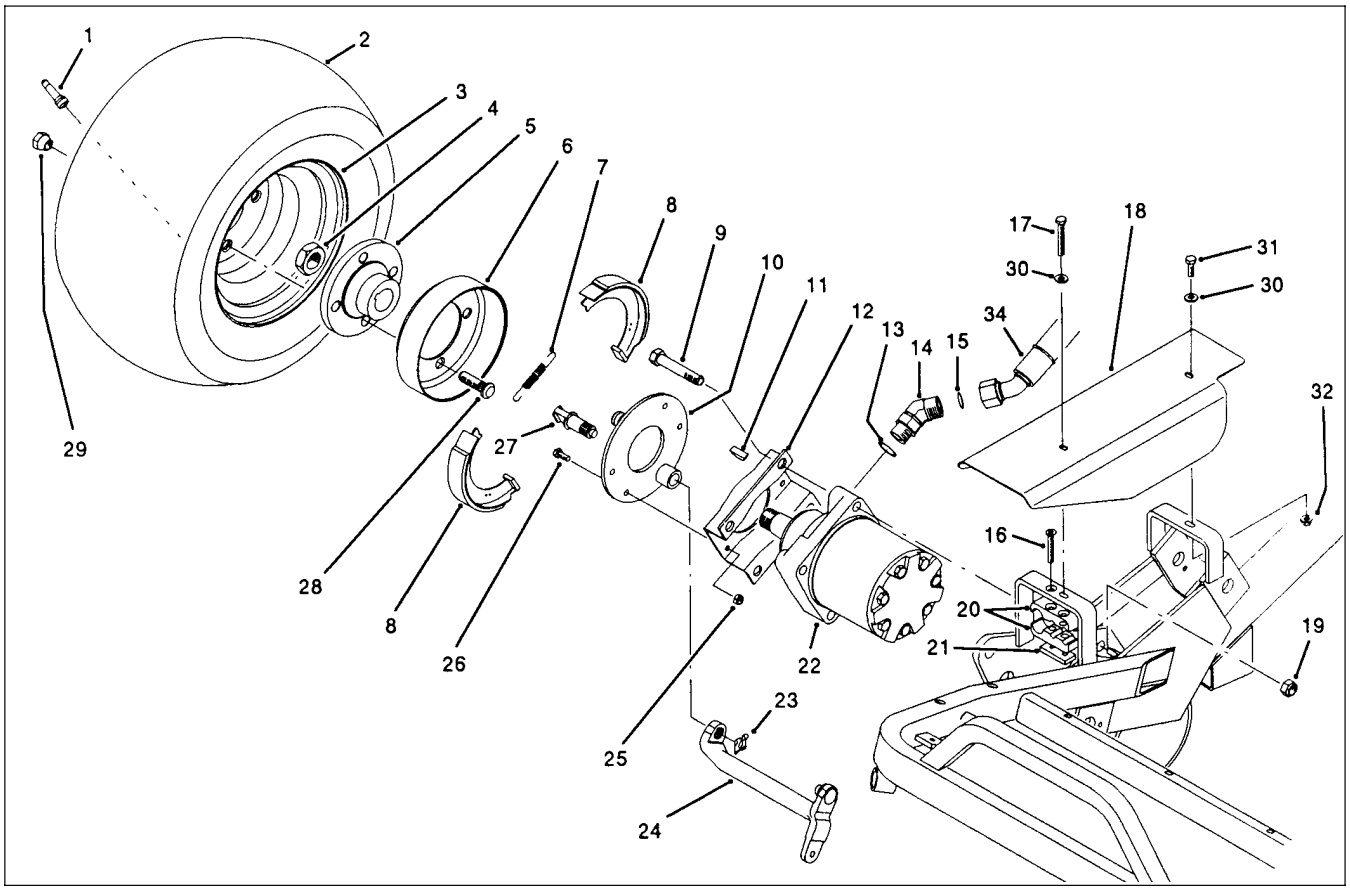

Figure 2

Brake Disassembly

1 Place blocks on each side of opposite wheel, jack machine up and place blocks beneath frame under wheel motor.

2. Remove wheel nuts (Item 29) and remove wheel. Remove large nut (Item 4) securing wheel hub (Item 5) to motor shaft.

IMPORTANT: To prevent damage to wheel motor, DO NOT hit wheel hub with a hammer during removal or installation.

3. Mount a wheel puller to the wheel mount studs and remove wheel hub. Remove key (Item 11) from motor shaft.

4 Remove brake shoe springs (Item 7) and brake shoes (Item 8). Disconnect brake linkage.

5.Repair or replace parts as necessary.

Reassembly

1. Insert small hook end of tension springs into the hole in each brake shoe plate from the outside. Connect large spring ends into opposite shoe plate. The springs should be in opposite direction from each other.

2. Install brake cam (Item 27). Connect actuating linkage and secure clevis locknut with a cotter pin.

3. Mount key in wheel shaft so top of key is in line with taper of shaft and install wheel hub and nut. Tighten nut to a torque of 250 to 400 ft-lb.

4. Install wheel assembly. Tighten wheel nuts to a torque of 40 to 50 ft-lb.

5. Adjust and check brakes. (See Brake Adjustment in the Adjustments section of this chapter.)

Steering Arm (Greensmaster 3050)

1. Remove 1/2–13 x 3/4″ capscrew and .53 I.D. washer mounted to outside steering arm frame bracket.

2. Pivot steering arm upward aligning mounting holes in arm with holes in frame bracket.

3. Select desired mounting hole for operator comfort and secure with a (2) 1/2–13 x 3/4″ capscrews and .53 I.D. washers (one each in loose parts).

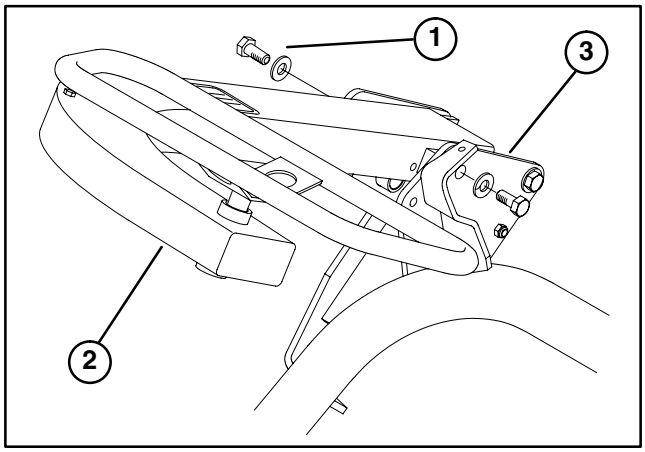

Figure 3

1. Capscrew and washer
2. Steering arm
3. Frame bracket

Steering Cable (Greensmaster 3050)

Steering cable tension should be adjusted whenever play is felt in the steering wheel. A loose steering cable will make it difficult to steer in a straight line. however, over tightening cable will cause undue wear to pulleys and cause cable to stretch and fail prematurely. When properly tensioned, cable should deflect 1/2″ at mid span when 11 lbs. of force is applied.

1. Tension cable by securing cable end hex with an open end wrench and turning the nut on the cable end with another wrench.

2. If all threads on the cable end have been used, replace cables. If necessary, service the pulley and steering cable under the steering wheel by removing the cover on the end of the steering column

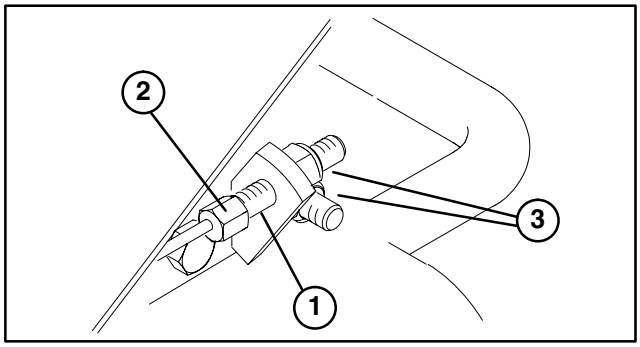

Figure 4

1. Steering cable
2. Hold with wrench
3. Turn to remove slack

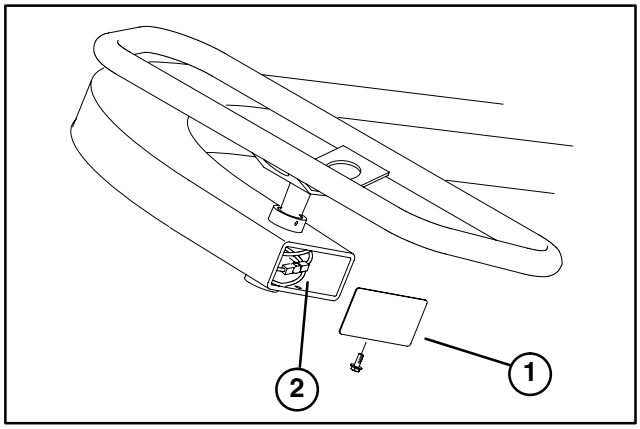

Figure 5

1. Cover
2. Pulley and steering cable

TORO®

Chapter 7

4 Bolt Adjust Cutting Units

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Lift Bail Replacement 20

Specifications

Height of Cut: 3/16 (0.1875) in. to 11/16 (0.6875) in.

Clip Frequency and Optimum Height of Cut Range:

Model No.	Clip (max.)	Optimum Height of Cut Range
Model 04407, 04408:	0.25 in.	3/16" - 5/16"

Roller Adjustment:
Front: Micrometer hand adjustment with bolted camp lock (1 turn = 0.025 in. height of cut change).
Rear: Pivot arm change on slot in side plate with locking nuts for paralleling roller to reel and adjusting bedknife attitude.

Bedknife To Reel Adjustment: Bedknife adjusts against reel, with opposed screw adjustment on each end of bedbar.

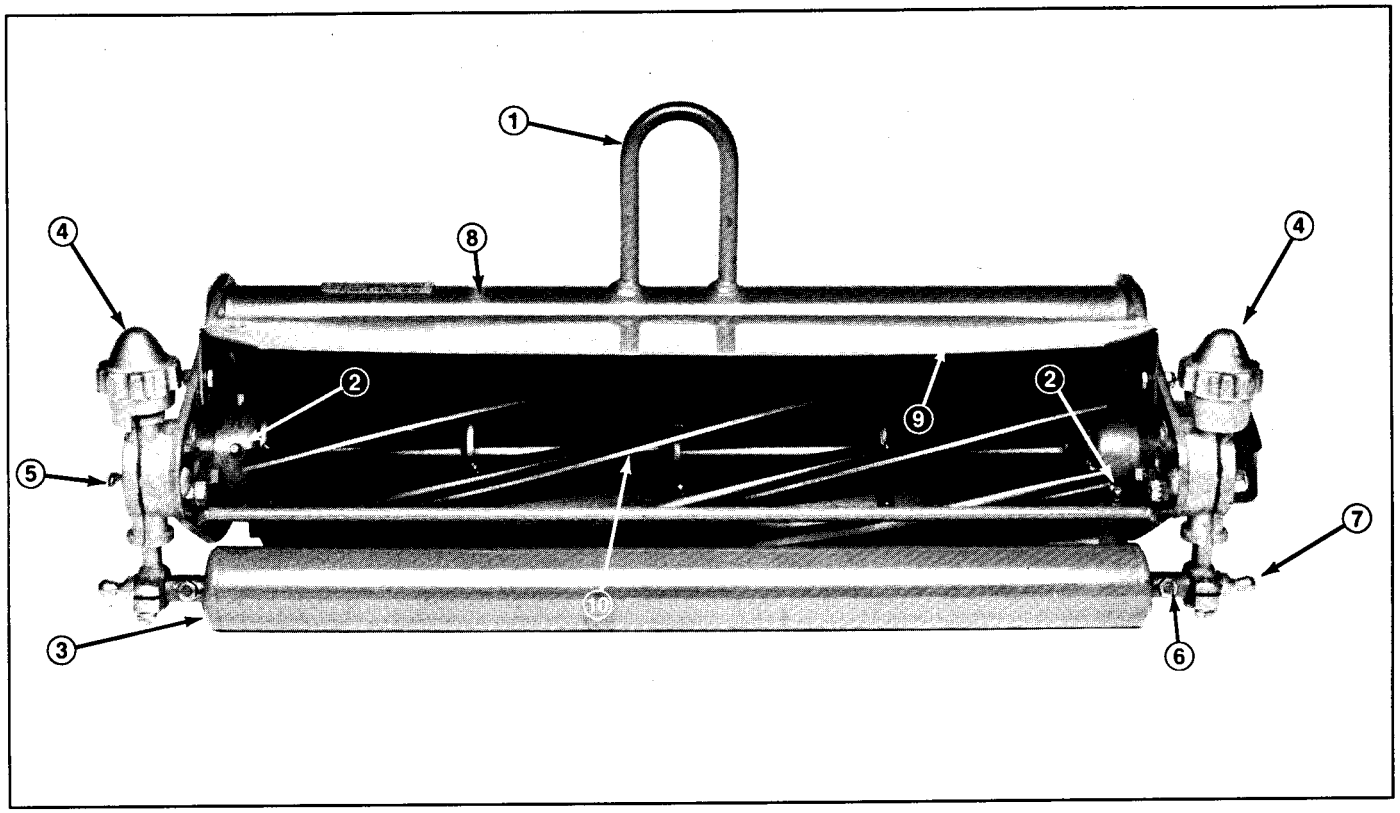
Reel Speed: 1940 rpm (engine speed 2800 rpm).

Bedknife Screw Torque: 200 in-lb.

Reel Splined Drive Nut Torque: 40 to 60 ft-lb.

Reel Bearing Rolling Torque: 7 in-lb. max.

Front or Rear Roller Run-Out: 0.14 in. max.



1. Lift bail
2. Grease fittings - reel bearings
3. Grease fittings - roller
4. Height of cut adjustment knob (2)
5. Height of cut adjustment locknut
6. Scraper adjusting nut (4)
7. Pull rod studs (2)
8. Grass shield
9. Adjustable grass shield bar
10. Reel

Special Tools

NOTE: Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*. Some tools may be listed in the Greensmaster 3000 or 3000-D Parts Catalog. Some tools may also be available from a local supplier.

Roller Bearing Replacement Tool

Puller is used to remove bearings from front and rear rollers. Driving tubes are used to install bearings into rollers. Refer to instructions supplied with tool. Used on swaged, full and wiehle rollers.

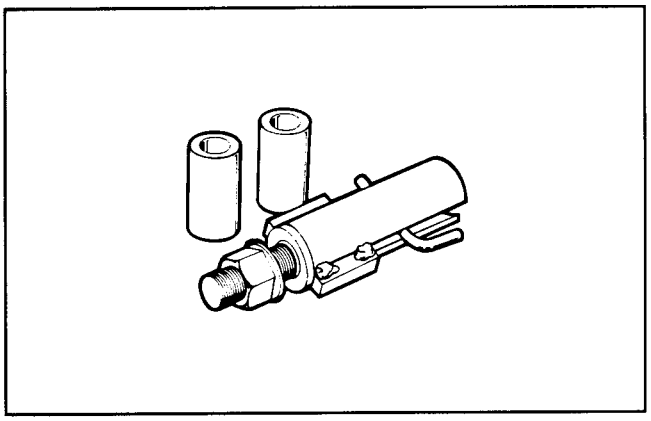


Figure 1

Plastic Plug

Insert plug in cutting unit bearing housing in place of reel motor when sharpening or grinding the reel.

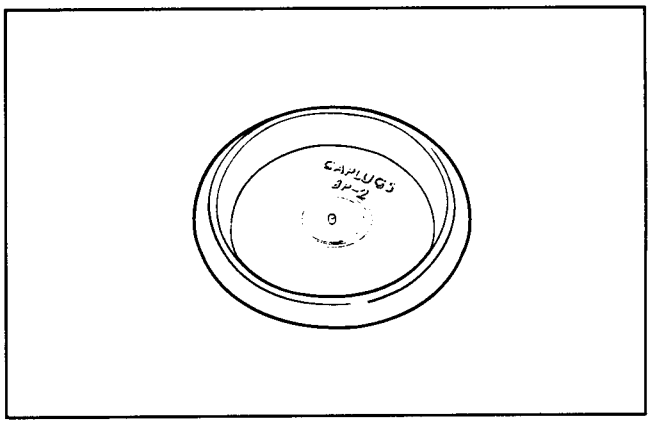


Figure 2

Handle Assembly

For applying lapping compound to cutting units while keeping hands a safe distance from the rotating reel assembly.

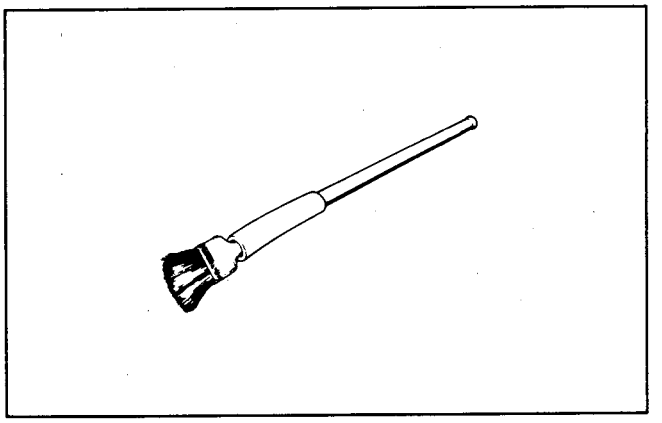


Figure 3

Bedknife Screw Tool

Fits Toro bedknife attaching screws. Use with torque wrench to secure bedknife to bedbar. With clean bedbar threads and new screws, tighten to a torque of 200 in-lb.

NOTE: Remove all rust, scale and corrosion from bedbar surface before installing bedknife.

DO NOT use an air impact wrench with this tool.

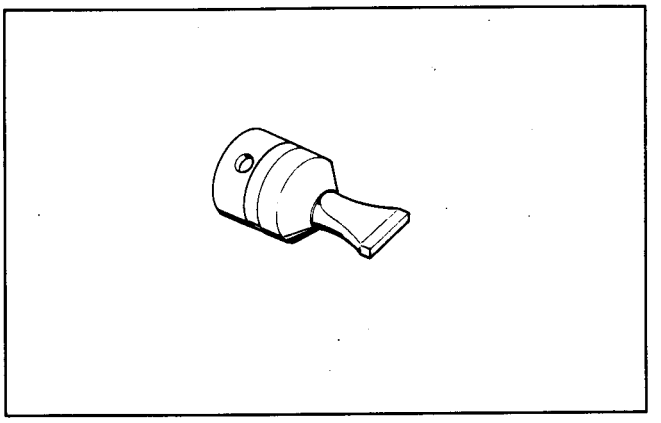


Figure 4

Troubleshooting

There are a number of factors that can contribute to unsatisfactory quality of cut, some of which may be turf conditions. Turf conditions such as excessive thatch, "sponginess" or attempting to cut off too much grass height may not always be overcome by adjusting the machine. It is important to remember that the lower the height of cut, the more critical these factors are. See the Adjustments and Repairs sections for detailed adjustment and repair information.

Factors Affecting Quality of Cut

Factor	Possible Problem/Correction
1. Tire pressure.	Check tire pressure adjust to specification if necessary. Must be equal in two front tires.
2. Engine governed speed.	Check maximum governed engine speed. Adjust to specification if necessary - affects reel speed.
3. Reel bearing condition/adjustment.	Check and adjust to specification. Replace bearings if worn or damaged. Bearing cones must be installed square to bearing housing - make sure there is no "flash", paint or other foreign material in housing before installing new bearing cone.
4. Reel and bedknife sharpness.	Reel and/or bedknife that has rounded edge cannot be corrected by tightening bedknife to reel contact. Grind reel to remove taper (cone shape) and/or rifling (grooved or ribbed appearance). Grind bedknife to sharpen and/or remove rifling. (Most common cause of rifling is bedknife to reel contact that is too tight.) NOTE: New bedknife must be ground after installing on bedbar to match bedknife to bedbar.
5. Bedknife to reel contact.	Reel must have light contact all across bedknife. No contact will dull the cutting edges. Excessive contact accelerates wear; quality of cut may be adversely affected. Adjust, backlap or grind if necessary.
6. Bedknife attitude.	Adjust rear roller brackets to proper location in slots of side plate. (See Leveling Rear Roller to Reel in the Adjustments section.)
7. Rear roller parallel to reel.	Check and adjust as necessary to avoid mismatch between cutting units.
8. Height of cut.	All cutting units set at same height of cut. Set with front roller – must be equal at both ends of roller. Bench set height of cut and actual (effective) height of cut are different. Effective height of cut depends on cutting unit weight, cutting unit accessories and turf conditions.
9. Proper bedknife for height of cut.	If bedknife is too thick for effective height of cut, poor quality of cut will result.
10. Front roller scraper and comb Adjustment.	Set scraper 1/32 in. clearance from roller. Set comb the same on all cutting units for height of cut and turf conditions. Must be same height at both ends of comb.

Factor	Possible Problem/Correction
11. Stability of bedbar.	Make sure bed bar pivot bolts are securely seated (maximum 40 ft-lb.) Make sure opposing bedknife adjustment screws are tight. To prevent distortion of the adjustment screw mounting plate and bedbar breakage, do not over-tighten the screws.
12. Number of reel blades.	Use cutting unit model with correct number of blades for clip frequency and optimum height of cut range. (Variable speed traction kit can be used to adjust clip frequency.)
13. Cutting unit alignment and pull frame ground following.	Check pull frame alignment on all cutting units. Adjust or repair as necessary. Check lift arms, pull frames for binding, bushing wear or damage. Repair if necessary.
14. Roller condition	All rollers must rotate freely. Grease when needed or repair bearings if necessary.
15. Reel speed.	All reels must rotate at same speed (within 100 rpm). All cutting units must have equal bedknife to reel contact and reel bearing adjustment before checking. Do not run the reel to long or it may get hot and rifle when no grass is being cut. See Troubleshooting in Chapter 5 - Hydraulic System.
16. Traction speed.	Check maximum governed engine speed. Adjust to specification if necessary. See Troubleshooting in Chapter 5 - Hydraulic System Install Variable Speed Traction Kit if necessary to control traction speed in varying conditions or with different attachments. Will allow change in traction speed while maintaining full engine rpm and reel motor rpm.
17. Cutting drop speed and sequence.	Center cutting unit must drop after front cutting unit. (See Troubleshooting in Chapter 5 - Hydraulic System.

Set Up and Adjustments

Adjustment Summary and Check List

DETAILED ADJUSTMENT INSTRUCTIONS FOLLOW THIS SUMMARY AND CHECK LIST. Study this information and refer to it often to get maximum life and performance from the cutting units.

Daily Performance Checks

NOTE: It is not necessary to remove the cutting units from the traction unit to perform these daily checks. It is recommended that mowers be washed after each use. Always remove key from ignition switch when working on the machine.

1. Purge all water and debris from all of the bearings by greasing them. Use No. 2 multi-purpose lithium base grease.

2. Visually check for sharp reel and bedknife.

- Remove burrs, nicks, and rounded edges.

3. Lower cutting units to the ground (setting on both rollers). Remove reel motor and rotate the reel backwards by hand. Light contact between the bedknife and reel should be felt and heard.

- It should be possible to pinch newspaper when inserted form the front and cut paper when inserted at a right angle (along entire length of bedknife).
- It should be possible to cut paper with minimum bedknife to reel contact. Should excessive reel drag be evident you must back lap or grind the cutting unit.
- No contact will dull the cutting edges.
- Excessive contact accelerates wear, and quality of cut may be adversely affected.

Weekly Checks

1. Check reel bearing adjustment and bearing condition.

2. Make sure bed bar pivot bolts are securely seated (maximum 40 ft-lb.).

3. Using a gauge bar, verify correct height of cut setting and adjust as necessary.

Monthly Adjustments

NOTE: Remove cutting unit from traction unit before doing these checks and adjustments (See Cutting Unit Removal and Installation in the Repairs section of this chapter.)

1. Visually check for sharp reel and bedknife. Backlap or grind reel and bedknife if necessary.

2. Adjust rear roller for proper bedknife angle and parallel to reel.

3. Adjust front roller scraper to be 1/32 in. from roller.

4. Set comb or brush adjustment for desired action on grass.

- Light, medium, or aggressive setting.

5. Check grass shield adjustment.

- 4-3/4 in. from crossbar - normal.
- Dry grass - lower shield.
- Wet grass - raise shield.

6. Set top bar (cut-off bar) adjustment.

- 0.060 in. from reel - normal.

7. Lower cutting units to the ground (setting on both rollers), remove reel motor and adjust bedknife to reel contact.

8. Using a gauge bar, set the height of cut adjustment.

Special Notes

1. A "rifled" reel and/or bedknife must be corrected by grinding.

2. If reel bearings will not hold adjustment during operation, loosen adjustment nut, tighten reel shaft *spline nut* to a torque of 40 to 60 ft-lb, then adjust reel bearings.

Reel Bearing Service and Adjustment

1. Adjust the bedknife so it is not in contact with the reel.

2. Reel bearing drag should not exceed 7 in-lb. This can be measured with a torque wrench (Fig. 5). If bearing drag does not meet above specification, adjust the reel bearings.

NOTE: If you do not have an inch-pound torque wrench, do steps 1 - 3 under Reel Bearing Adjustment below.

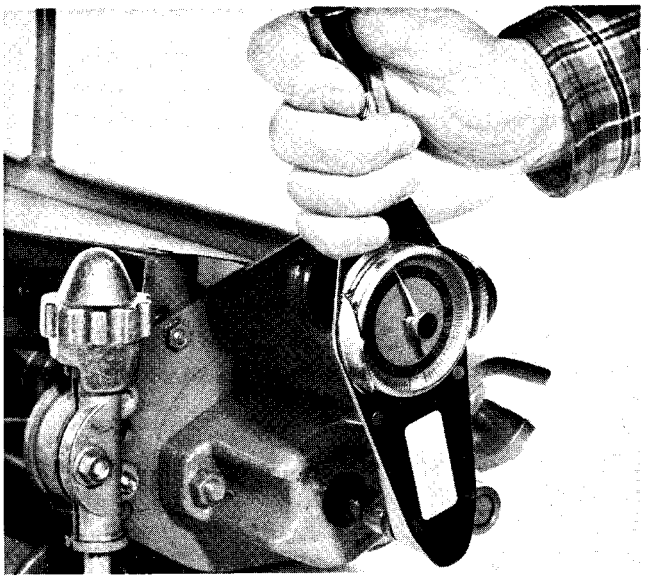


Figure 5

Reel Bearing Adjustment

1. Remove the mounting nuts from the counterbalance end cap and remove end cap from the mounting studs (Fig. 6).

2. Remove bolt mounted on the end of reel shaft. This will make it possible for a large socket wrench to be mounted on the reel bearing adjusting nut inside the side plate.

CAUTION

Do not use your hand to prevent reel from turning while servicing; this can result in personal injury. Use a 1/2 in. thick x 3 in. wide x 8 in. long piece of hardwood inserted into front of cutting unit between reel blades.

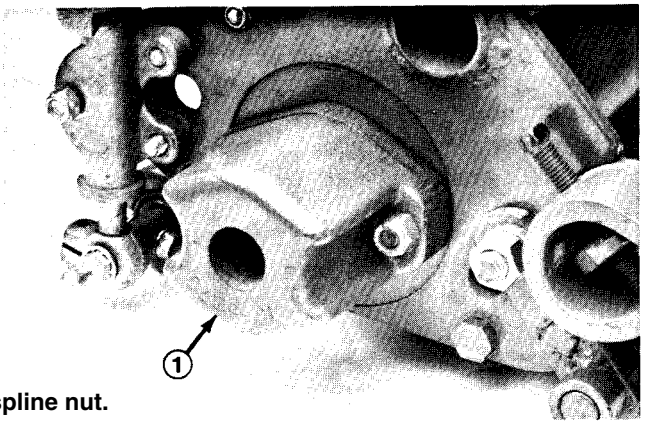


Figure 6

1. Counterbalance end cap

NOTE: If reel bearings will not hold adjustment during operation, loosen adjustment nut, tighten reel shaft spline nut on right hand end of reel shaft to a torque of 40 to 60 ft-lb, then adjust reel bearings. **Use Loctite 271 on spline nut.**

3. Loosen large reel bearing adjustment nut (Fig. 7). Tighten nut until all reel shaft end play is removed, then tighten an additional 1/16 to 1/8 turn. Be certain to remove all end play, but do not overtighten.

NOTE: Adjustment nut must have enough resistance against reel shaft threads to retain bearing adjustment. Replace adjustment nut if necessary.

4. Install bolt into end of reel shaft and check rolling torque with an inch-pound torque wrench (Fig. 7). Reel bearing rolling torque should not exceed 7 in-lb. Repeat setps 2 and 3 if necessary.

5. If bearings require replacement, see Reel Removal and Bearing Replacement in the Repairs section of this chapter.

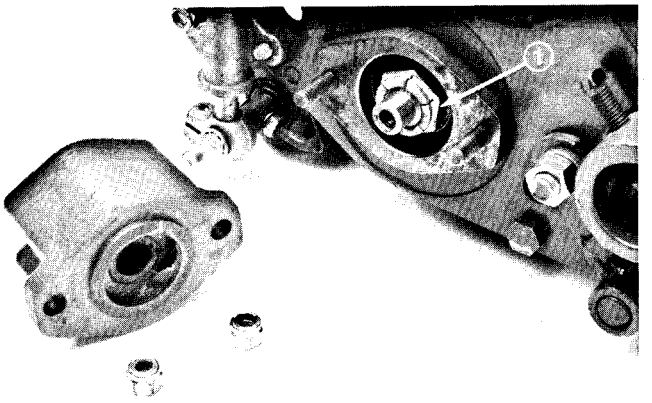


Figure 7

1. Reel bearing adjustment nut

Bedknife To Reel Adjustment

IMPORTANT: For adjusting bedknife to reel, use a 3/8 in. open end wrench that is 3 to 6 in. in length. A longer wrench will provide too much leverage and may cause distortion of the adjustment screw mounting plate or bedbar breakage.

1. To move bedbar closer to reel blades, loosen bottom screw on each side of cutting unit (Fig. 8), then tighten top adjustment screw on each side of cutting unit (Fig. 9). To move bedknife away from reel blades, loosen top screw on each side of cutting unit (Fig. 8), then tighten bottom adjustment screw on each side of cutting unit (Fig. 9).

2. After adjusting bedknife to reel, make sure that both the top and the bottom adjustment screws are secured at both ends of cutting unit (Fig. 8, 9).

3. After adjustment, check to see if reel can pinch paper when inserted from the front, and cut paper when inserted at a right angle (Fig. 10). It should be possible to cut paper with minimum contact between the bedknife and reel blades.

IMPORTANT: If excessive bedknife to reel contact is maintained; bedknife and reel wear will be accelerated. Uneven wear can result, and quality of cut may be adversely affected.

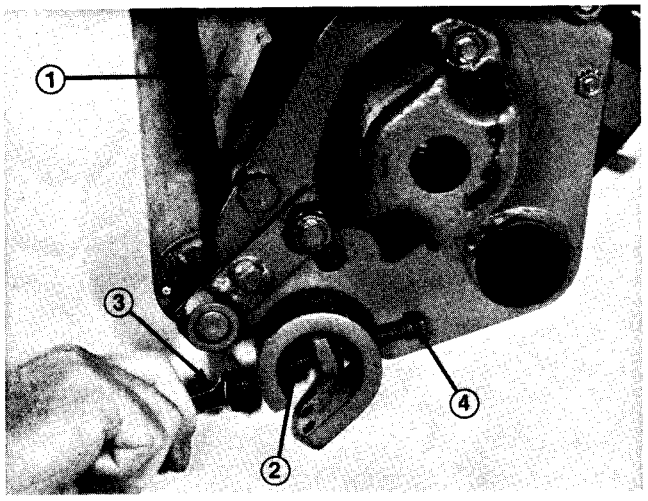


Figure 8

1. Bedknife
2. Bottom adjustment screw
3. 3/8 inch wrench
4. Top adjustment screw

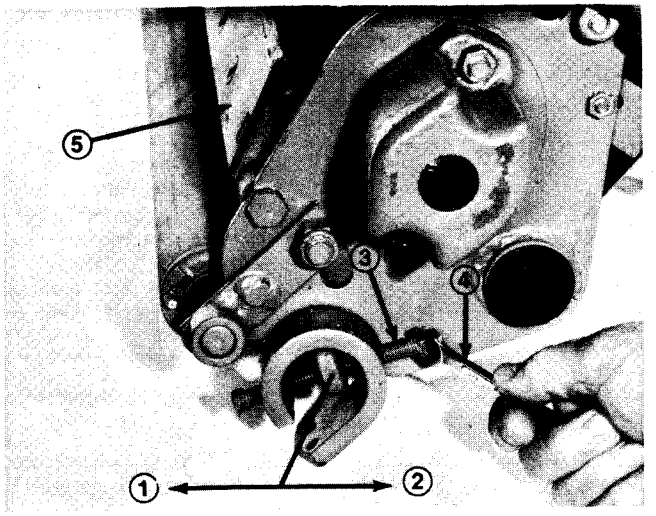


Figure 9

1. Bedknife closer to reel
2. Bedknife further from reel
3. Top adjustment screw
4. 3/8 inch wrench
5. Bedknife

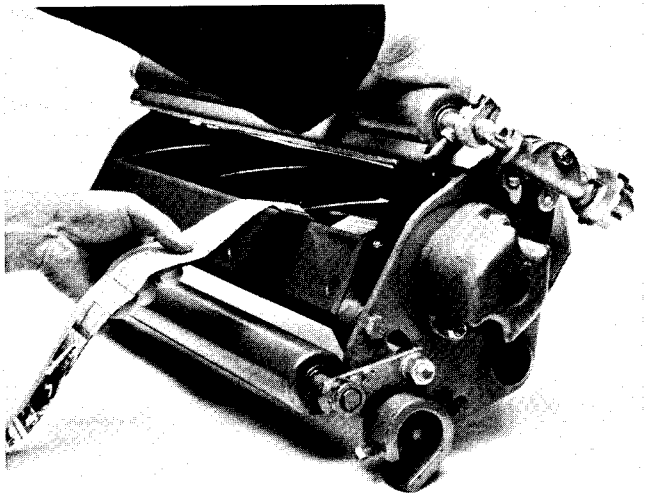


Figure 10

Leveling Rear Roller To Reel

1. Loosen rear roller brackets. Adjust one bracket and tighten the nut on the capscrew. See the table below for the proper adjustment. Leave bracket on the other side mounted loosely (Fig. 11).

Height of Cut	Distance from bottom of rear roller bracket (not bolt) to bottom of slot
1/8 (0.125) in. or below	1/16 (0.0625) in.
5/32 (0.156) to 1/8 (0.125) in.	1/8 (0.125) in.
1/4 (0.25) in. or above	center bracket in slot

NOTE: Position of rear roller bracket determines bedknife angle. Recommendations for rear roller bracket position in above chart are designed to give the best rear roller position (and bedknife angle) for different heights of cut.

IMPORTANT: Rear roller bracket position must be identical on all three (3) cutting units so bedknifes are at the same angle. If bedknifes are not at the same angle there will be a difference in the appearance of the cut grass (mismatch) for each cutting unit.

2. Place a 1/4 inch (6 mm) or thicker plate under the reel blades and against the cutting edge of the bedknife (Fig. 11).

NOTE: Be sure the plate covers the full length of reel blades.

3. With cutting unit reel blades positioned on the plate, hold cutting unit securely and push down on the rear roller assembly until it contacts the working surface across the full length of the roller (Fig. 12).

4. Tighten nut on rear roller bracket that was not tightened in step 1 to secure roller in place.

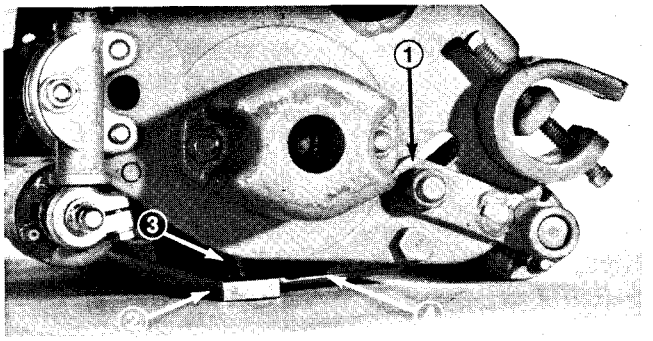


Figure 11

1. Rear roller bracket
2. 1/4 inch (6 mm) steel plate
3. Reel blades
4. Bedknife

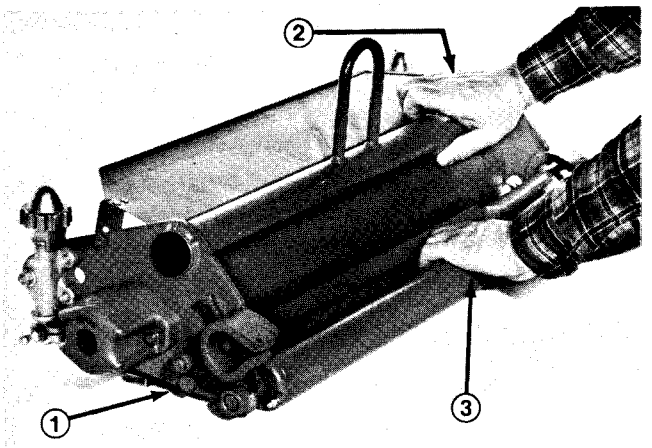


Figure 12

1. Unit on level surface
2. Hold unit securely
3. Push down on roller

Height Of Cut

Height of cut, as measured in the turf and on the cutting unit is different. The grass prevents the cutting unit from settling all the way to the ground line as the machine moves across the turf. Because of this, the actual (effective) height of cut is higher than the bench set height of cut.

Machine conditions, such as cutting unit weight, roller type, bedknife thickness, speed of travel and clip, influence effective height of cut. Turf conditions, such as grass type, grass density, and amount of thatch also influence effective height of cut.

Changing the machine (such as adding a wiehle roller) will increase penetration into the turf and lower the effective height of cut. Changing from a heavier single point adjust cutting unit to a lighter 4-bolt adjust cutting unit will reduce penetration into the turf and raise the effective height of cut.

Height of Cut Adjustment

IMPORTANT: Lower heights of cut are limited by thickness of bedknife. Select proper bedknife for desired height of cut. If bedknife is too thick for height of cut, poor quality of cut will result and excessive pressure from turf on bottom of bedknife can cause "rifling" of bedknife and reel.

1. To adjust height of cut, cutting unit should be turned over and the locknuts on each end of the cutting unit securing the height of cut adjusting knob loosened (Fig. 13).

2. On gauge bar (Part No. 1-8789), set head of screw to desired height of cut. This measurement is from bar face to underside of screw head.

3. Put the bar across the front and rear rollers and adjust the height of cut knob until the underside of the screw head engages the bedknife cutting edge (Fig. 10).

IMPORTANT: Do step 3 on each end of the bedknife. Tighten height of cut adjustment locknuts on both ends.

Changing To A Different Type of Cutting Unit or Adding Cutting Unit Accessories

When changing to a different type of cutting unit or adding cutting unit accessories, it is recommended that you change only one cutting unit, and keep the other two existing cutting units on the machine.

1. Set the new cutting unit to a height of cut approximately 1/16 (0.06) in. higher than the old cutting unit.

2. Do a mowing test and compare results between the new cutting unit and old cutting units.

3. Adjust the new cutting unit to match the cut of the old cutting units.

4. The other two cutting units can now be replaced. Adjust these two new cutting units so they are the same as the other new cutting unit that was tested.

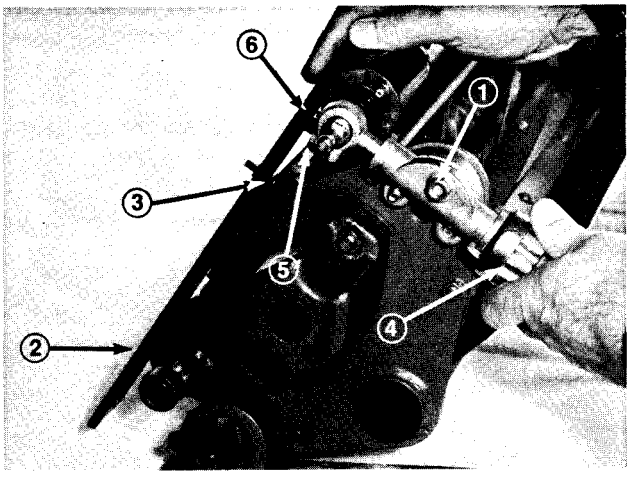


Figure 13

1. Height of cut knob locknut
2. Gauge bar (1-8789)
3. Gauge bar screwhead
4. Height of cut knob
5. Roller shaft clamp bolt
6. Comb assembly

Front Roller Scraper Adjustment

The front roller scraper should be adjusted so there is a clearance of approximately 1/32 of an inch between the scraper and roller (Fig. 14).

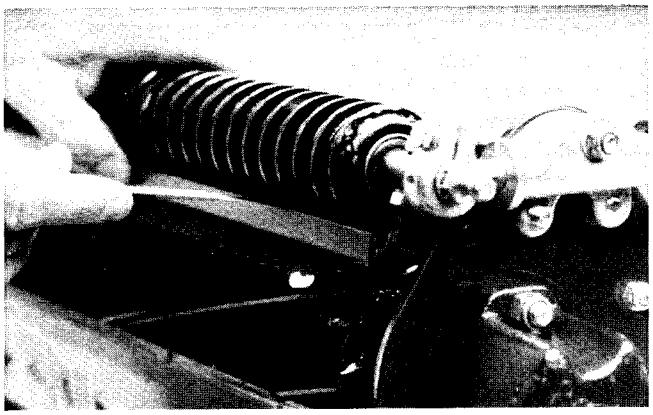


Figure 14

Comb Adjustment

1. Make sure rear roller is in the desired height of cut position. Loosen the bolts anchoring the front roller shaft (Fig. 15). Rotate the shaft.

2. To adjust the aggressiveness of the comb teeth (Fig. 15), proceed as follows:

   A. Teeth touching the adjusting gauge bar gives an **aggressive** setting.

   B. Adjustment of the comb assembly so it is midway between the adjusting gauge bar and the cutting edge of the bedknife gives a **medium** setting.

   C. Adjusting the comb assembly so it is even with the cutting edge of the bedknife gives a **light** setting.

NOTE: Securing one end of the comb assembly at a time simplifies the above procedure.

3. Tighten the roller shaft bolts.

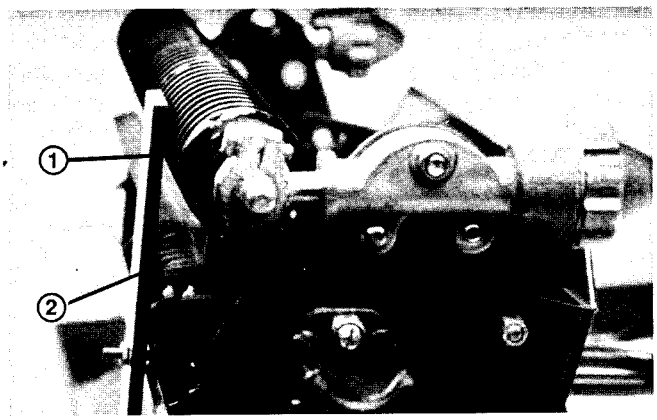


Figure 15

1. Roller shaft clamp bolt **2. Comb teeth**

Shield Height Adjustment

Adjust shield to get proper grass clipping discharge into basket:

1. Set cutting unit in normal cutting position and measure distance from top of front crossbar to shield at each end of cutting unit (Fig. 16).

2. Height of shield from crossbar for normal cutting conditions should be 4 3/4 inches. Loosen cap-screws and nuts securing shield to each side-plate, adjust shield to correct height and tighten fasteners (Fig. 16).

3. Repeat adjustment on remaining cutting units and adjust top bar. (See Top Bar Adjustment in this section of the book.)

NOTE: Shield can be lowered in dry grass conditions (clippings fly over top of baskets) or raised to allow for heavy wet grass conditions (clippings build up on rear edge of basket.

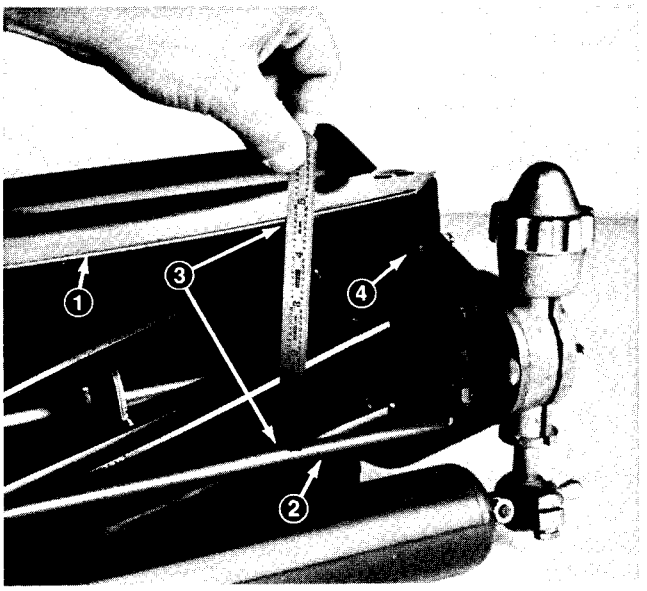


Figure 16

1. Shield
2. Front crossbar
3. 4-3/4 inches (12.1 cm)
4. Shield fasteners

Top (Cut Off) Bar Adjustment

Adjust top bar to make sure clippings are cleanly discharged from reel area:

1. Loosen screws securing top bar (Fig. 17). Insert 0.060 inch feeler gauge between top of reel and bar and tighten screws (Fig. 17). Make sure bar and reel are equal distance apart across complete reel.

2. Repeat settings on remaining cutting units.

NOTE: Bar is adjustable to compensate for changes in turf conditions. Bar should be adjusted closer to reel when turf is extremely wet. By contrast, adjust bar further away from reel when turf conditions are dry. Bar should be parallel to reel for optimum performance and should be adjusted whenever shield height is adjusted or whenever reel is sharpened on a reel grinder.

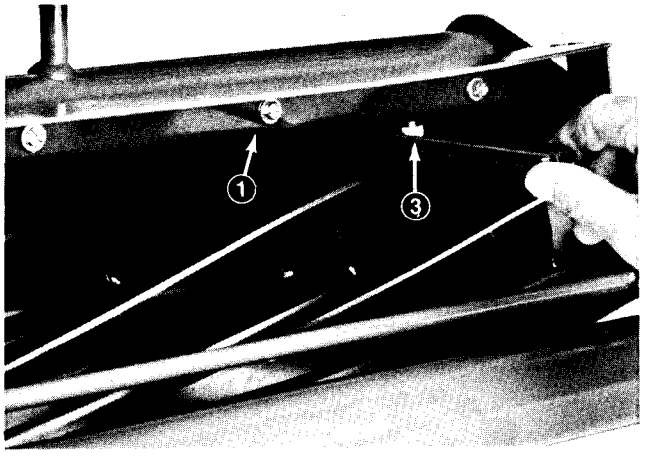


Figure 17

1. Top bar
2. Bar mounting screws
3. Feeler gauge

Pull Frame Adjustment

1. Put the basket on the pull frame.

2. Level baskets to cutting unit by loosening nut at one end of pull frame roller. Loosen bolt and move roller shaft in slot as necessary. Tighten bolt.

3. Loosen the jam nuts on the pull arms and adjust the ball sockets until there is 1/4 in. to 1/2 in. (6 to 13 mm) clearance between the lip of the basket and the reel blades (Fig. 18a). This prevents grass clippings from dropping on the ground.

4. Make sure the basket lips are the same distance from the reel blades at both ends of the reel. If the basket is too close to the reel, it is possible for the reel to contact the basket at the instant the cutting unit is raised off the ground.

5. Make sure each of the three (3) cutting units track straight with the traction unit:

A. On a smooth, level surface, draw a straight line on the floor (Fig. 18b). Push traction unit forward (removing slack from pull arms) so center of each front wheel is on top of the line. Use a plumb bob or square to make sure each wheel is centered on the line.

B. Measure from each end of cutting unit front roller to chalk line. Distance from each end of roller to line must be equal within 3/16 (0.187) in.

C. Loosen jam nuts on pull arms and adjust ball sockets so distance from each end of roller to line is within 3/16 (0.187) in.

NOTE: If a cutting unit cannot be adjusted to track correctly with the traction unit, the pull frame, or lift arm is damaged and/or the lift arm and pull frame bushings are worn and must be replaced.

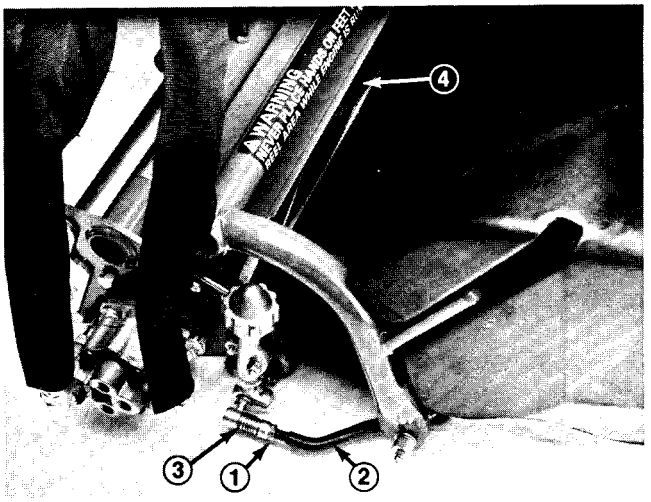


Figure 18a

1. Jam nut **3. Ball joint - adjust for clearance**
2. Pull arm **4. 1/4 - 1/2 in. (6 - 13 mm) clearance**

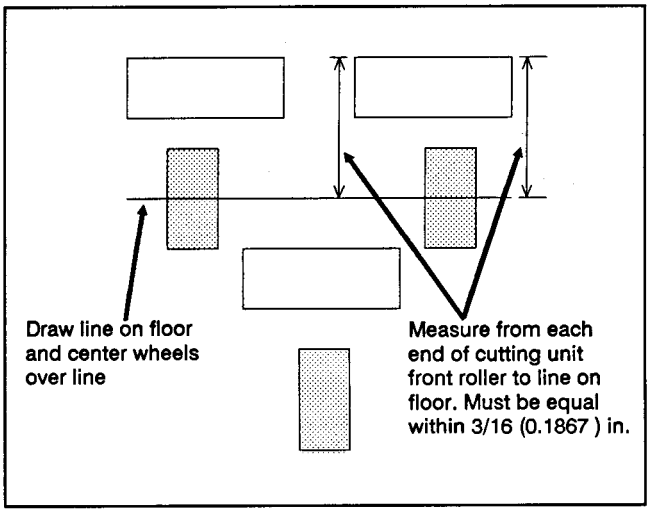


Figure 18b

Cutting Unit Removal and Installation

Remove cutting unit from traction unit before doing adjustments or repairs.

1. Remove basket from pull frame.

2. Loosen reel motor mounting nuts (Fig. 19). Rotate the motor clockwise so motor flanges clear studs and pull motor off of cutting unit.

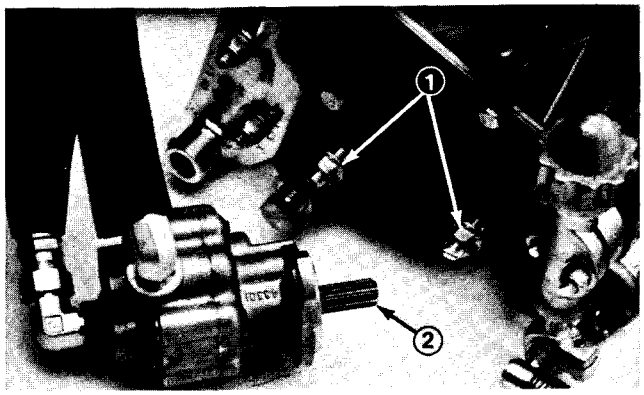


Figure 19

1. Motor mount nuts
2. Motor shaft

3. Slide the sleeve back on the ball joint and disconnect the pull arm from each side of the cutting unit (Fig. 20).

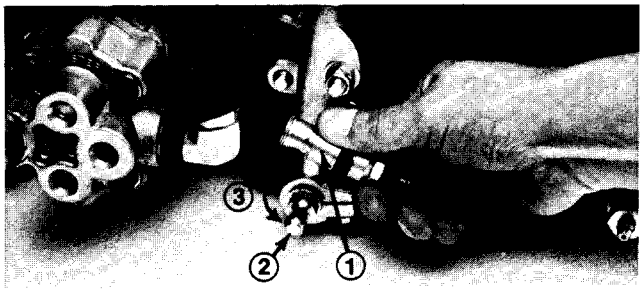


Figure 20

1. Slide back to mount
2. Ball stud
3. Swing up to remove, down to install

4. Slide cutting unit out from under pull frame, disengaging the lift arm from the lift bail (Fig. 21).

5. Reverse steps 1 - 4 to install the cutting unit.

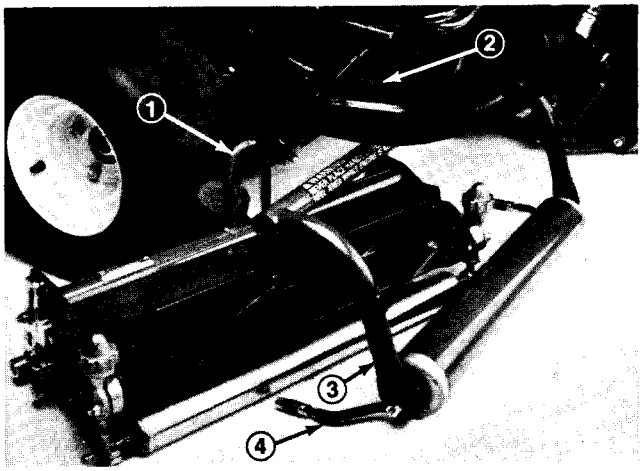


Figure 21

1. Lift bail
2. Lift arm
3. Pull frame
4. Pull arm

Reel Lapping

Check reel bearing adjustment and correct if necessary before backlapping. Connect a lapping machine to the cutting unit with an extension coupler, and a 9/16 socket. The 9/16 socket can be positioned onto the capscrew on the reel shaft inside the counter-balance weight on the end of the cutting unit (Fig. 22). Backlap according to procedures in the Toro publication "Sharpening Reel & Rotary Mowers, Form No. 80-300-PT.

NOTE: For a better cutting edge, run a file across the front face of the bedknife when the lapping operation is completed. This will remove any burrs or rough edges that may have built up on the cutting edge.

CAUTION

Be careful when lapping the reel because contact with the reel or other moving parts can result in personal injury.

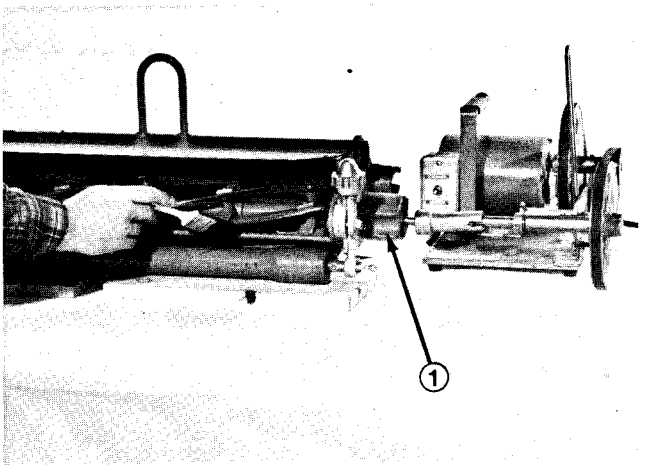


Figure 22

1. Counterbalance weight

Bedbar Removal and Installation

1. Remove rear roller assembly.

2. Remove capscrew and nut anchoring the rear roller height-of-cut bracket to the side plate on both ends of the cutting unit (Fig. 23).

3. Loosen allen set screws securing the roller shaft (Fig. 23).

4. Remove the rear roller height-of-cut brackets from both side plates.

5. Remove the bedbar mounting bolts from each end of the cutting unit (Fig. 23). Then loosen the bedknife adjusting screws at each end of the cutting unit (Fig. 23). The bedknife assembly can then be removed by rotating it away from the reel.

IMPORTANT: When installing the bedbar assembly, be sure to position the center portion of the grass shield over the rear edge of the bedbar (Fig. 24). Securely seat the (2) bedbar pivot bolts to a maximum torque of 40 ft-lbs. Always check reel bearing adjustment after installing bedbar.

NOTE: For proper grinding of bedknife follow procedures in the Toro publication "Sharpening Reel & Rotary Mowers", Form No. 80-300-PT.

6. Reverse steps 1 - 5 to install the bedbar.

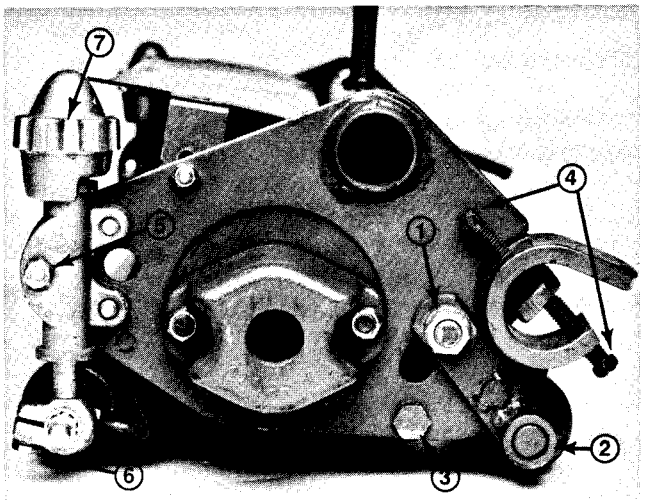


Figure 23

1. Rear roller height of cut bracket
2. Allen set screw
3. Bedbar mounting bolts
4. Bedknife adjusting screws
5. Height of cut rod locknuts
6. Roller shaft clamp bolts
7. Height of cut adjustment knob

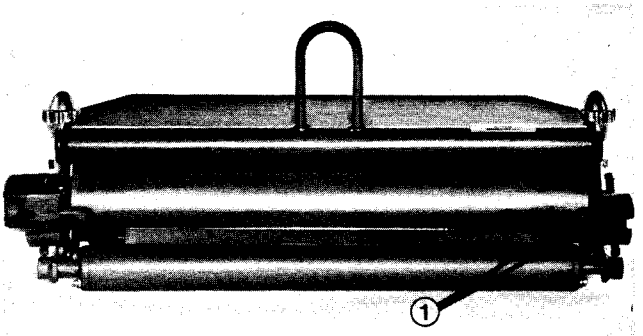


Figure 24

1. Bedbar under lip of shield

Bedknife Replacement

1. Remove bedbar.

2. Remove bedknife screws and remove bedknife.

3. Remove all rust, scale and corrosion from bedbar surface before installing the bedknife.

4. Install new bedknife with the proper bedknife screws (57-4910). Bedknife screws must bottom out on the bedknife, not the bedbar. Tighten the screws to a torque of 200 in-lb, working from the center toward each end of the bedbar (Fig. 25).

5. Grind the new bedknife to match it to the bedbar.

NOTE: For proper grinding of bedknife, follow procedures in the Toro publication "Sharpening Reel and Rotary Mowers", Form No. 8O-300-PT.

6. Install the bedbar.

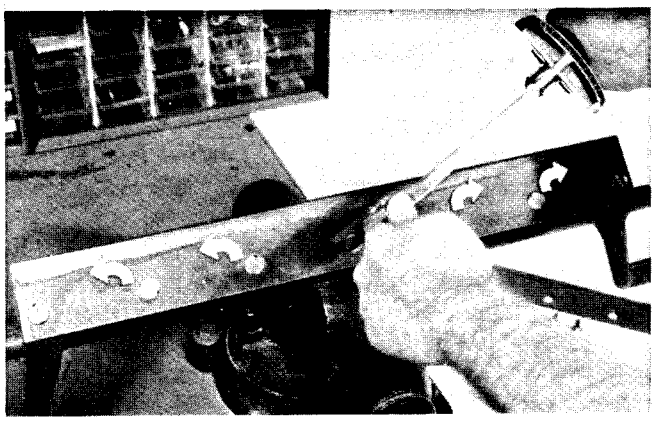


Figure 25

Preparing Reel For Grinding

IMPORTANT: Adjust reel bearings before grinding reel. (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter.

1. Remove bedbar.

NOTE: Some reel grinders may require rear roller assembly be mounted to the cutting unit for proper support in reel grinder. Rear roller must be parallel to reel shaft to remove taper when grinding.

2. If necessary, remove front roller assembly.

   A. Loosen the locknuts securing height of cut adjusting rods at both ends of the cutting unit and the roller shaft clamp bolts (Fig. 26).

   B. Turn height of cut adjustment knobs until they are disconnected from the height of cut adjusting rods (Fig. 26). The roller assembly can then be removed from the cutting unit by pulling evenly on both sides.

For proper grinding of reel, follow procedures in the Toro publication "Sharpening Reel & Rotary Mowers, Form No. 80-300-PT.

3. Install bedbar. After grinding, assemble cutting unit, do all adjustments. Back lap if necessary to get desired fit between reel and bedknife.

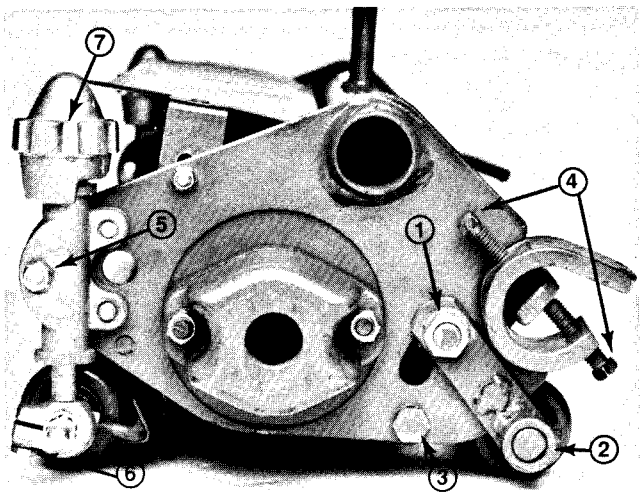


Figure 26

1. Rear roller height of cut bracket
2. Allen set screw
3. Bedbar mounting bolts
4. Bedknife adjusting screws
5. Height of cut rod locknuts
6. Roller shaft clamp bolts
7. Height of cut adjustment knob

Reel Removal and Bearing Replacement

1. Remove the front and rear roller assembly. Remove bedbar.

2. Remove counterbalance end cap from left hand side of cutting unit (Fig. 27). Remove large bearing adjustment nut from left hand end of reel shaft (Fig. 27) and special spline nut from opposite end of reel shaft.

3. Remove machine screws securing bearing housing on each end of cutting unit (Fig. 28). Machine screw heads will have to be cut off before screw can be completely removed:

A. Unscrew machine screw approximately two turns.

B. Cut head off of machine screw.

C. Use a screw driver to back out remaining part of screw from side plate (outwards, not inwards towards reel). If machine screw does not have a screw driver slot, use a pliers to back out screw.

IMPORTANT: Remove grease fittings from bearing housing at each end of cutting unit. Note that the straight fitting is on the right end, and 90° fitting at the left end (when viewed in the direction of travel).

4. Use a plastic headed hammer to rotate bearing housing slightly, install bolts from outside of housing and turn bolts alternately against side plate to remove bearing housing (Fig. 29). Bearing housing will slip out of side plates and reel assembly can be removed as soon as bearing housings are disassembled from side plates.

5. Before installing reel, install new special machine screws from inside of frame to secure bearing housing.

6. If necessary, install new bearings and seals:

A. Remove outer seal (in counterbalance weight), bearing cup, bearing cone and inner seal.

B. Bearing housing must be completely free of paint and foreign material before installing bearing cup. If necessary, remove any "flash" from bearing housing that may interfere with accurate seating of bearing. Install new inner seal. Install bearing cup.

C. Install bearing housing to frame. Pack bearing cone with grease and install over reel shaft into bearing cup. Install outer seal (in counterbalance weight).

7. After installing reel, tighten spline nut to 40 - 60 ft-lb, then adjust bearings (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter.)
Use Loctite 271 on spline nut.
8. Install bedbar. Install front and rear roller assembly.

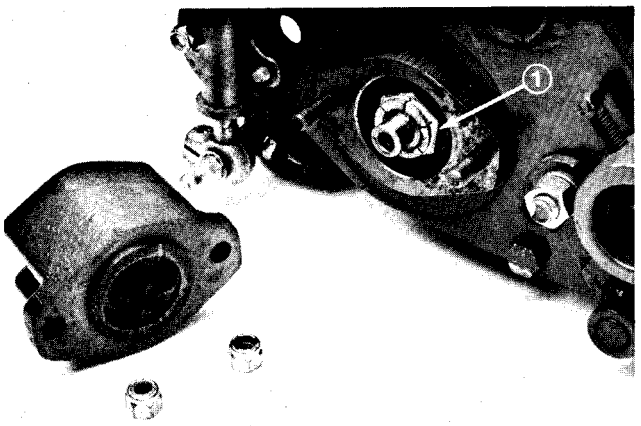


Figure 27

1. Reel bearing adjustment nut

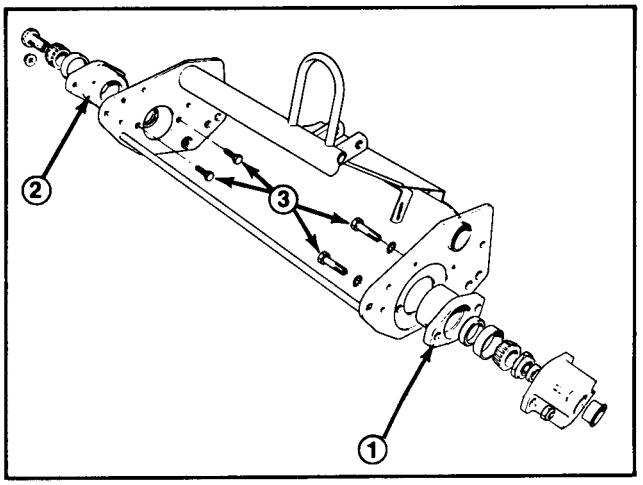


Figure 28

1. Left reel bearing housing
2. Right reel bearing housing
3. Machine screws

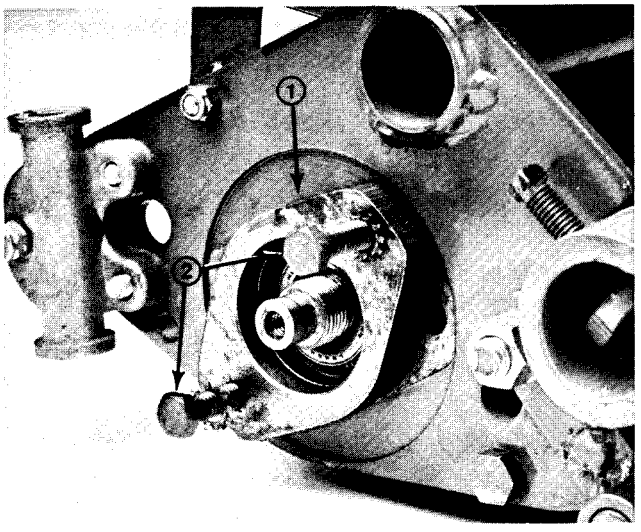


Figure 29

1. Bearing housing - rotate slightly
2. Bearing housing mount bolts - thread against side plate to remove housing

Lift Bail Replacement

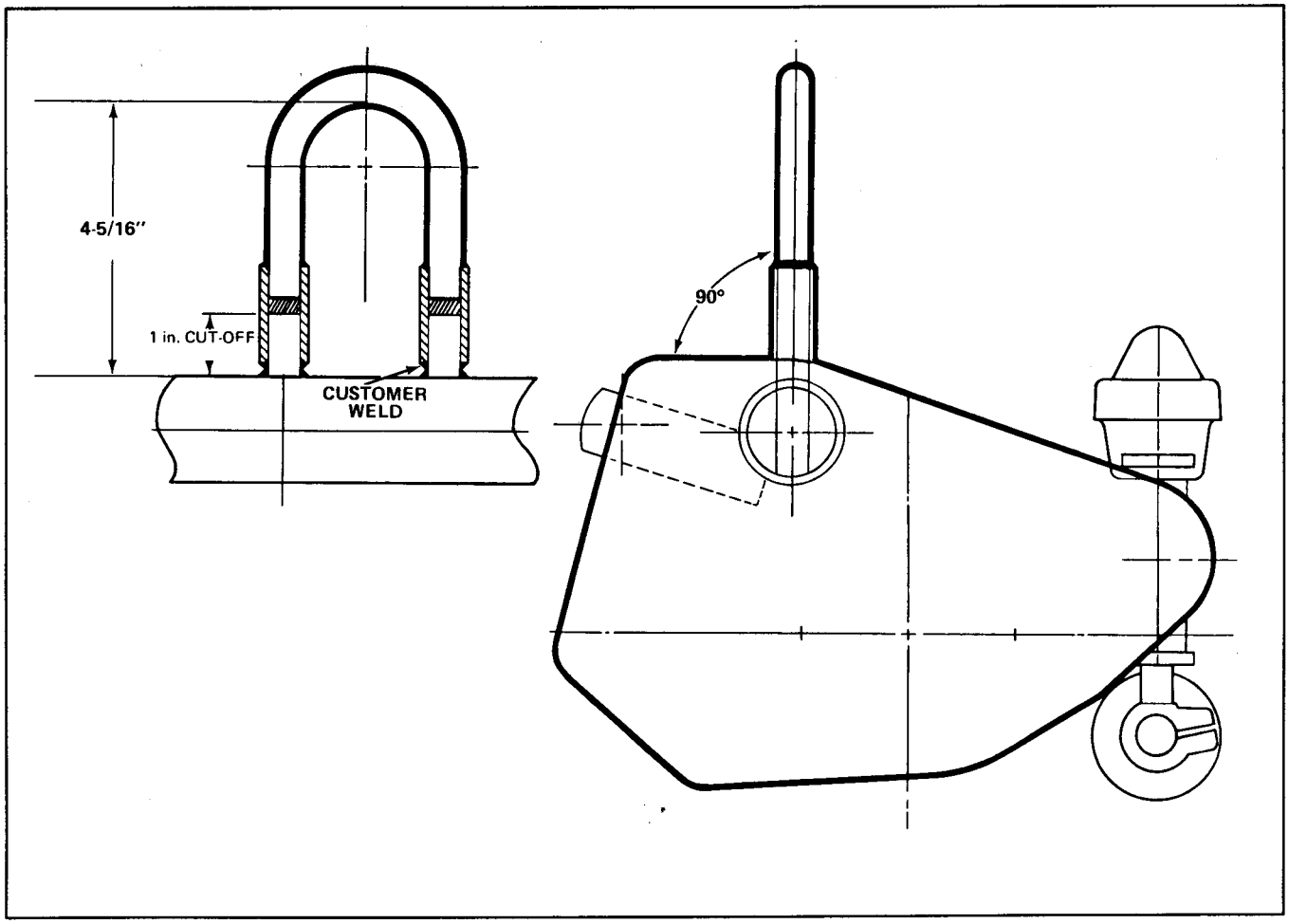


Figure 30

1. Use a saw to cut the lift bail off of the cutting unit. Make the cut 1 inch from the horizontal frame tube (Fig. 30).

2. Use a grinder to remove burrs from the stubs of the lift bail remaining on the cutting unit.

3. Install the repair lift bail (Part No. 71-1600).

4. Support the lift bail so the bottom radius is 4 5/16 inches from the top of the horizontal frame tube. Make sure the lift bail is square to the side frame.

5. Weld all around the bottom of the repair lift bail with mild steel rod, both sides.

Chapter 8

Single Point Adjust Cutting Units

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Specifications

Height Of Cut: 3/32 (0.094) in. to 3/4 (0.75) in.

Clip Frequency and Optimum Height of Cut Range:

Model No.	Clip (max.)	Optimum Height of Cut Range
Model 04445:	0.40 in.	5/16" - 1/2"
Model 04458, 04468:	0.25 in.	3/16" - 5/16"
Model 04450:	0.18 in.	1/8" - 7/32"

Roller Adjustment:
Front: Micrometer hand adjustment with bolted clamp lock (1 turn 0.025 in. height of cut change).
Rear: Roller brackets allow adjustment for different height of cuts. Screw adjustment for leveling.

Bedknife To Reel Adjustment: Bedknife adjusts against reel, with positive adjustment control knob located at center of bedbar. Adjustment knob contains detent with .001 inch movement of bed-knife for each indexed position. Pivot point at top of bedbar is greaseable.

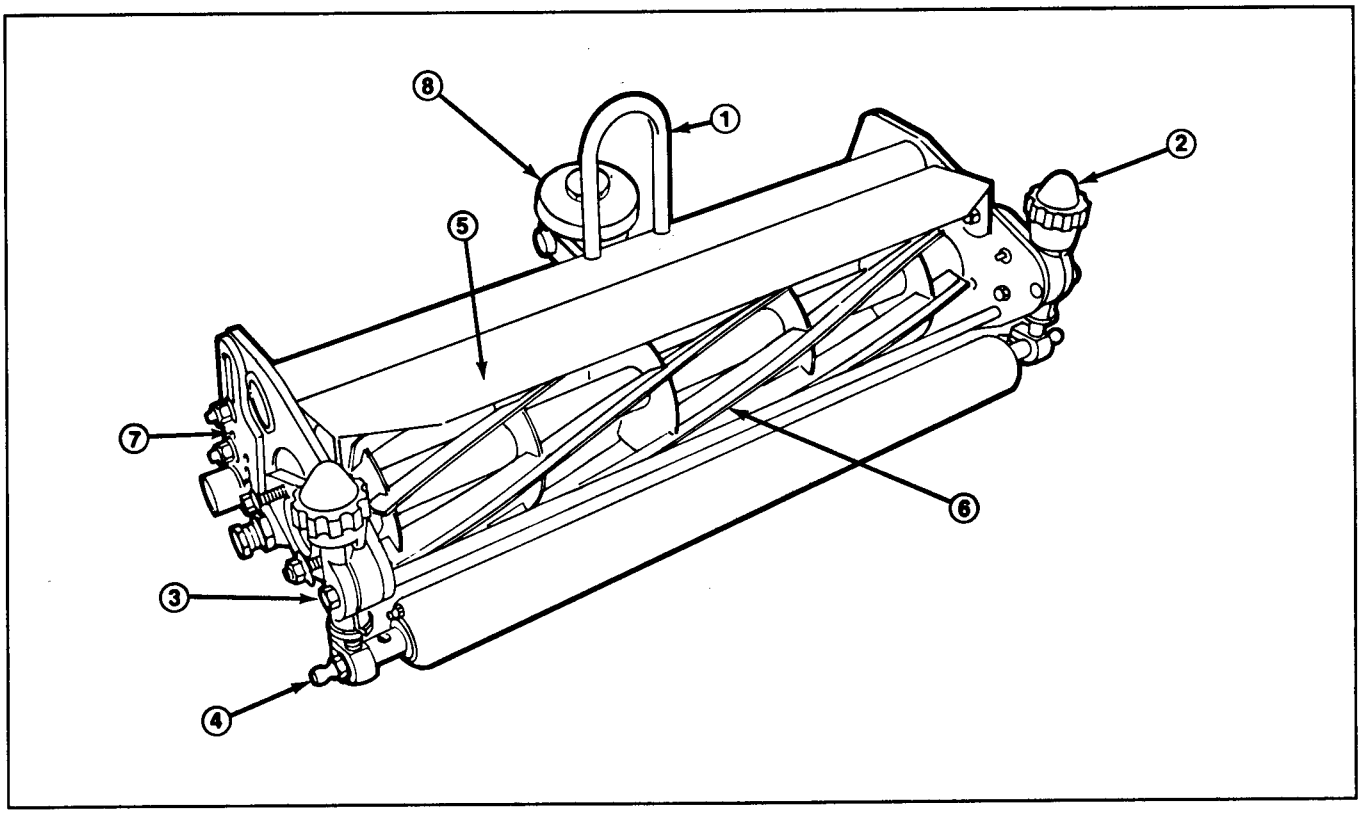
Reel Speed: 1940 rpm (engine speed 2800 rpm).

Bedknife Screw Torque: 200 in-lb.

Reel Splined Drive Nut Torque: 40 to 60 ft-lb.

Reel Bearing Rolling Torque: 7 in-lb. maximum with bedknife to reel contact removed.

Front or Rear Roller Run-Out: 0.014 in. max.



1. Lift bail
2. Height of cut adjustment knob
3. Height of cut adjustment locknut
4. Pull rod studs
5. Grass shield
6. Reel
7. Height of cut brackets (2)
8. Bedknife adjusting knob

Special Tools

NOTE: Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*. Some tools may be listed in the Greensmaster 3000 or 3000-D Parts Catalog. Some tools may also be available from a local supplier.

McLube

Aerosol or liquid lubricant. Apply to bedbar pivot and bedbar pivot bolts.

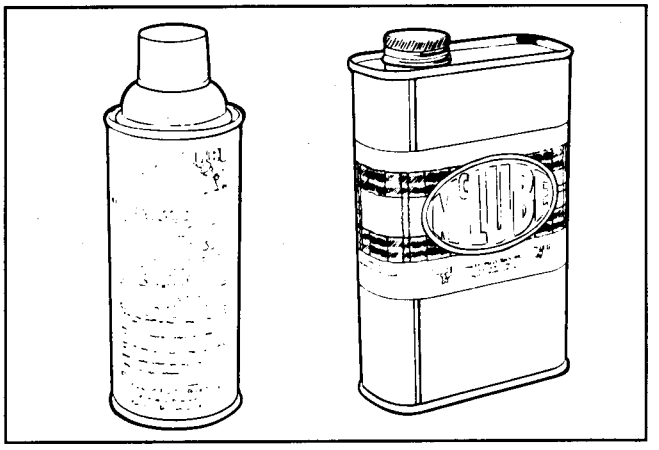


Figure 1

Roller Bearing Replacement Tool

Puller is used to remove bearings from front and rear rollers. Driving tubes are used to install bearings into rollers. Refer to instructions supplied with tool. Used on swaged, full and wiehle rollers.

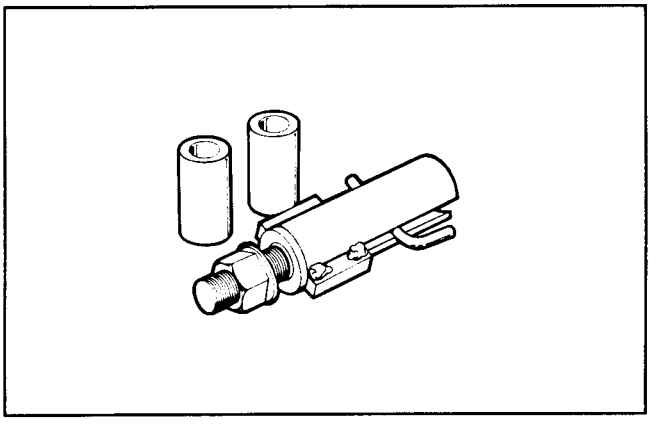


Figure 2

Plastic Plug

Insert plug in cutting unit bearing housing in place of reel motor when sharpening or grinding the reel.

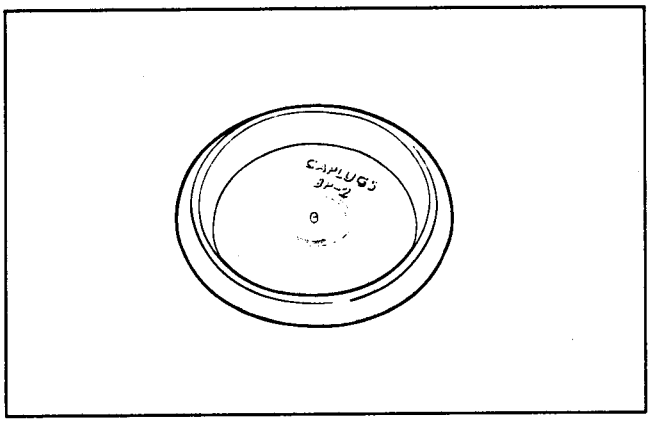


Figure 3

Handle Assembly

For applying lapping compound to cutting units while keeping hands a safe distance from the rotating reel assembly.

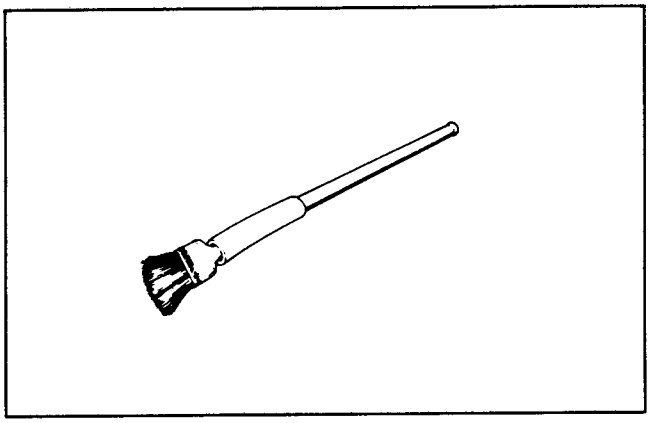


Figure 4

Bedknife Screw Tool

Fits Toro bedknife attaching screws. Use with torque wrench to secure bedknife to bedbar. With clean bedbar threads and new screws, tighten to a torque of 200 in-lb.

NOTE: Remove all rust, scale and corrosion from bedbar surface before installing bedknife.

DO NOT use an air impact wrench with this tool.

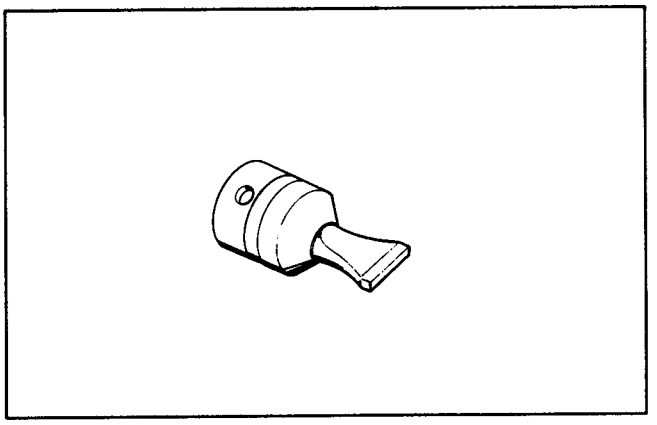


Figure 5

Troubleshooting

There are a number of factors that can contribute to unsatisfactory quality of cut, some of which may be turf conditions. Turf conditions such as excessive thatch, "sponginess" or attempting to cut off too much grass height may not always be overcome by adjusting the machine. It is important to remember that the lower the height of cut, the more critical these factors are. See the Adjustments and Repairs sections for detailed adjustment and repair information.

Factors Affecting Quality of Cut

Factor	Possible Problem/Correction
1. Tire pressure.	Check tire pressure and adjust if necessary. Must be equal in both front tires.
2. Engine governed speed.	Check maximum governed engine speed. Adjust to specification if necessary – affects reel speed.
3. Reel bearing condition/adjustment.	Check and adjust to specification. Replace bearings if worn or damaged. Bearing cones must be installed square to bearing housing - make sure there is no "flash", paint or other foreign material in housing before installing new bearing cone.
4. Reel and bedknife sharpness.	Reel and/or bedknife that has rounded edge cannot be corrected by tightening bedknife to reel contact. Grind reel to remove taper (cone shape) and/or rifling (grooved or ribbed appearance). Grind bedknife to sharpen and/or remove rifling. (Most common cause of rifling is bedknife to reel contact that is too tight.) NOTE: New bedknife must be ground after installing on bedbar to match bedknife to bedbar.
5. Bedknife parallel to reel.	Check and adjust as necessary.
6. Bedknife to reel contact.	Check before operating with cutting unit on ground. Remove reel motor and rotate reel by hand. Turn adjusting knob one (1) click at a time until first contact between reel and bedknife is felt or heard, then tighten one (1) more click to get light contact. No contact dulls cutting edges. Excessive contact increases wear.
7. Bedknife attitude (rear roller bracket hole position).	Set to recommendations in chart on Page 9 - 12.
8. Rear roller parallel to reel.	Check and adjust as necessary.
9. Height of cut.	All cutting units set at same height of cut. Set with front roller – must be equal at both ends of roller. Bench set height of cut and actual (effective) height of cut are different. Effective height of cut depends on cutting unit weight, cutting unit accessories and turf conditions.
10. Proper bedknife for height of cut.	If bedknife is too thick for effective height of cut, poor quality of cut will result.
11. Front roller scraper and comb adjustment.	Set scraper for 1/32 in. clearance from roller. Set comb the same on all cutting units for height of cut and turf conditions. Must be same height at both ends of comb.

Factor	Possible Problem/Correction
12. Stability and position of bedbar.	Make sure bedbar bolt plastic washers are snug against bedbar. Bedbar must pivot without binding. Check bedbar end bushings, pivot bushings and nylon flange bushings for wear or damage and replace if necessary. Make sure proper bushings are installed in each location (bedbar end bushings are different). Check adjustment knob to make sure detent holds adjustment. Repair if necessary. With adj. knob/pivot assembly removed, pivot set screws installed, and frame on level surface, measure from flat surface up to end of each setscrew. If not within 1/16 in. of each other, bend ears on cutting unit frame to line up screws. Check to make sure adj. knob/pivot assembly is centered in bedbar arm yoke and frame ears so that an equal gap exists on each side of pivot housing before pivot screws are installed. Make sure bedknife adj. knob/pivot assembly is held firmly in place between frame supports.Tighten pivot screws if necessary.
13. Number of reel blades.	Use cutting unit model with correct number of blades for clip frequency and optimum height of cut range. (Variable speed traction kit can be used to adjust clip frequency.)
14. Cutting unit alignment and pull frame ground following.	Check pull frame alignment on all cutting units. Adjust or repair as necessary. Check pull frames and lift arms for damage, binding or bushing wear. Repair if necessary.
15. Roller condition	All rollers must rotate freely. Grease when needed or repair bearings if necessary.
16. Reel speed.	All reels must rotate at same speed (within 100 rpm). All cutting units must have equal bedknife to reel contact and reel bearing adjustment before checking. Do not run the reel to long or it may get hot and rifle when no grass is being cut. See Troubleshooting in Chapter 5 - Hydraulic System.
17. Traction speed.	Check maximum governed engine speed. Adjust to specification if necessary. See Troubleshooting in Chapter 5 - Hydraulic System Install Variable Speed Traction Kit if necessary to control traction speed in varying conditions or with different attachments. Will allow change in traction speed while maintaining full engine rpm and reel motor rpm.
18. Cutting drop speed and sequence.	Center cutting unit must drop after front cutting unit. (See Troubleshooting in Chapter 5 - Hydraulic System.

Set Up and Adjustments

Adjustment Summary and Check List

DETAILED ADJUSTMENT INSTRUCTIONS FOLLOW THIS SUMMARY AND CHECK LIST. Study this information and refer to it often to get maximum life and performance from the cutting units.

Daily Performance Checks

NOTE: It is not necessary to remove the cutting units from the traction unit to perform these daily checks. It is recommended that mowers be washed after each use. Always remove key from ignition switch when working on the machine.

1. Purge all water and debris from all of the bearings by greasing them. Use No. 2 multi-purpose lithium base grease.

2. Visually check for sharp reel and bedknife.

- Remove burrs, nicks, and rounded edges.

3. Lower cutting units to ground (setting on both rollers) and remove reel motor. Rotate the reel by hand. TURN ADJUSTING KNOB ONE (1) CLICK AT A TIME UNTIL FIRST CONTACT BETWEEN REEL AND BEDKNIFE IS FELT AND HEARD THEN TIGHTEN ONE (1) MORE CLICK TO GET LIGHT CONTACT *.

- No contact will dull the cutting edges.
- Excessive contact accelerates wear; quality of cut may be adversely affected.

* It is best to make the reel to bedknife adjustment in the morning, immediately before each day of mowing.

Weekly Checks

1. Check reel bearing adjustment and bearing condition.

2. Make sure bed bar bolt "plastic washers" are SNUG against the bedbar.

3. Make sure bedknife adjustment knob/pivot assembly is held FIRMLY in place between frame supports.

4. Using a gauge bar, verify the correct height of cut setting.

Monthly Adjustments

NOTE: Remove cutting unit from traction unit.

1. Parallel bedknife to reel.

- Use newspaper as a feeler gauge.
- Dot on eccentric bolt must face rear of mower.
- Turn S.P.A. adjustment knob to hold paper on right-hand end of bedknife.
- Turn eccentric (left) bedbar bolt to hold paper on left-hand end of bedknife.
- Hold eccentric bedbar bolt while securing locknut.

2. Adjust rear roller parallel to reel; eccentric bolt faces to rear.

3. Adjust the front roller scraper to be 1/32 in. from roller.

4. Set comb or brush adjustment for desired action on grass.

- Light, medium, or aggressive setting.

5. Check grass shield adjustment.

- 4-3/4 in. from crossbar - normal.
- Dry grass - lower shield.
- Wet grass - raise shield.

6. Set top bar (cut-off bar) adjustment.

- 0.060 in. from reel - normal.

7. Set cutting unit on ground (setting on both rollers) and remove reel motor. Adjust bedknife to reel contact.

8. Use a gauge bar to set the height of cut.

Special Notes

1. Replace the bedbar bushings and nylon flange bushings every two years.

2. A "rifled" reel and/or bedknife must be corrected by grinding.

3. After extended running, notches will eventually develop at both ends of the bedknife. These notches must be rounded off or filed flush with cutting edge of bedknife to assure smooth operation.

4. If reel bearings will not hold adjustment during operation, loosen adjustment nut, tighten reel shaft *spline nut* on right hand end of reel shaft to a torque of 40 to 60 ft-lb, then adjust reel bearings.

Bedknife to Reel Contact

NOTE: The single knob bedknife-to-reel adjustment system simplifies the adjustment procedure needed to get the best mowing performance. The precise adjustment possible with the single knob/bedbar design gives the necessary control to provide a continual self-sharpening action – thus maintaining sharp cutting edges, assuring good quality-of-cut, and greatly reducing the need for routine backlapping. In addition, the rear roller positioning system permits optimum bedknife attitude and location for varying heights-of-cut and turf conditions.

IMPORTANT: Bedknife to reel contact must be checked and adjusted every day even though quality of cut is acceptable.

1. Shut off engine and remove key. Lower cutting units to the ground.

2. Remove grass baskets.

3. On each cutting unit, loosen (2) flange nuts securing reel motor to cutting unit. Twist motor clockwise to disengage from cutting unit and remove motor.

4. Slowly rotate reel, listening for reel-to-bedknife contact. If no contact is evident, TURN BEDKNIFE ADJUSTING KNOB CLOCKWISE, ONE (1) CLICK AT A TIME, UNTIL FIRST CONTACT IS FELT AND HEARD THEN TIGHTEN ONE (1) MORE CLICK TO GET LIGHT CONTACT (Fig. 6).

5. If contact is felt, turn bedknife adjusting knob counterclockwise, one (1) click at a time until no contact is evident. Turn bedknife adjusting knob one (1) click at a time clockwise, until first contact is felt and heard then tighten one (1) more click to get light contact.

6. Install hydraulic motor to cutting unit.

IMPORTANT: LIGHT CONTACT MUST BE MAINTAINED AT ALL TIMES. If light contact is not maintained, bedknife and reel edges will not self-sharpen sufficiently. This will result in dull cutting edges after a period of operation. If excessive contact is maintained bedknife/reel wear will be accelerated. Uneven wear can result, and quality of cut may be adversely affected.

NOTE: As the reel blades continue to run against the bedknife a slight burr will appear on the front cutting edge surface the full length of the bedknife. If a file is occasionally run across the front edge to remove this burr, improved cutting performance can be obtained.

NOTE: After extended running, notches will eventually develop at both ends of the bedknife. These notches must be rounded off or filed flush with cutting edge of bedknife to assure smooth operation.

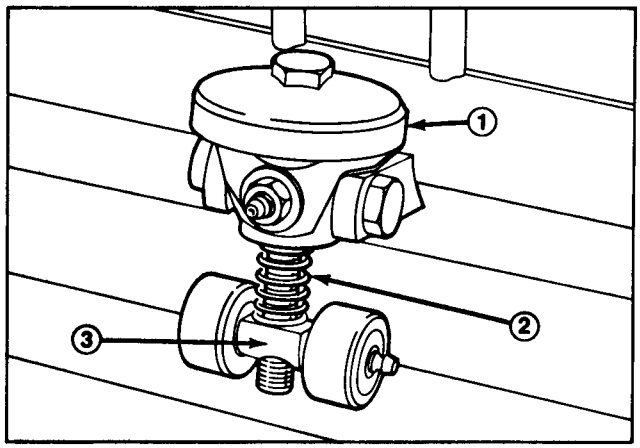


Figure 6a
(Tool-adjustable knob)

1. Bedknife adjusting knob **3. Pivot bar**
2. Compression spring

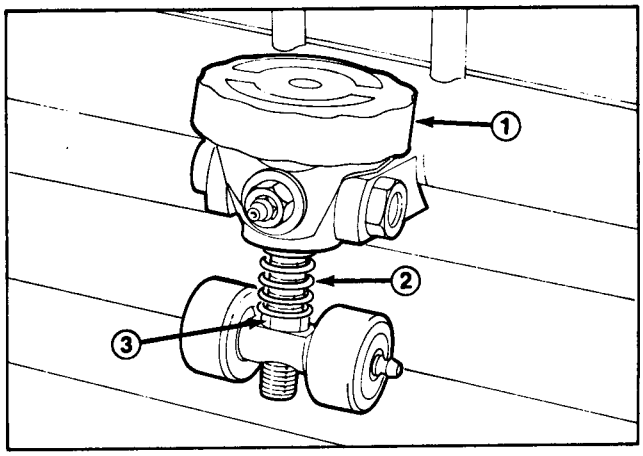


Figure 6b
(Hand-adjustable knob)

1. Bedknife adjusting knob **3. Locknut (left-hand thread)**
2. Compression spring

Reel Bearing Service and Adjustment

1. First, make sure bedknife to reel contact is removed by turning bedknife adjustment knob counterclockwise (Fig. 6).

2. Reel bearing rolling torque should not exceed 7 in-lb. Measure with an inch-pound torque wrench (Fig. 7). If bearing drag does not meet above specifications, adjust reel bearings.

NOTE: If you do not have an inch-pound torque wrench, do steps 1 - 3 under Reel Bearing Adjustment below.

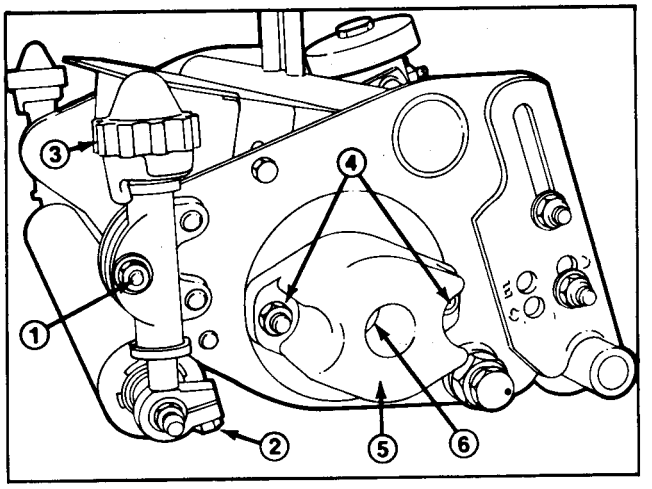


Figure 7

1. Height of cut locknut
2. Roller shaft clamp bolt
3. Height of cut knob
4. End cap mounting nuts
5. Counterbalance end cap
6. Reel bearing adjustment nut

Reel Bearing Adjustment

1. Remove mounting nuts from counterbalance end cap and remove end cap from mounting studs (Fig. 7).

2. Remove bolt mounted on the end of reel shaft. This will make it possible for a large socket wrench to be mounted on the reel bearing adjusting nut inside the side plate.

CAUTION

Do not use your hand to prevent reel from turning while servicing; this can result in personal injury. Use a 1/2 in. thick x 3 in. wide x 8 in. long piece of hardwood inserted into front of cutting unit between reel blades.

NOTE: If reel bearings will not hold adjustment during operation, loosen adjustment nut, tighten reel shaft *spline nut* on right hand end of reel shaft to a torque of 40 to 60 ft-lb, then adjust reel bearings. **Use Loctite 271 on spline nut threads.**

3. Tighten the large reel bearing adjustment nut (Fig. 7) until all reel shaft end play is removed, then tighten an additional 1/16 to 1/8 turn. Be certain to remove all end play, but do not over-tighten.

NOTE: Adjustment nut must have enough resistance against reel shaft threads to retain bearing adjustment. Replace adjustment nut if necessary.

4. Install bolt into end of reel shaft and check rolling torque with an inch-pound torque wrench. Reel bearing rolling torque, should not exceed 7 in-lb. Repeat steps 2 and 3 if necessary.

5. If bearings require replacement, see Reel Removal and Bearing Replacement in the Repairs section of this chapter.

Parallel Bedknife to Reel

1. Remove mower from traction unit and position on a level work surface. Make sure reel contact is removed by turning bedknife adjustment knob counterclockwise.

2. On right-hand end of reel, insert a long strip of newspaper between front side of reel and bedknife. While slowly rotating reel forward, turn bedknife adjusting knob (Fig. 8) clockwise, one click at a time, until paper is pinched lightly, which results in a slight drag when paper is pulled.

3. Check for light contact at other end of reel using paper. If light contact is not evident at both ends, bedknife is not parallel to reel, proceed to step 4.

4. Loosen jam nut on left hand bedbar pivot bolt so bolt can be turned. Left hand pivot bolt (eccentric bolt) has offset thread which, when rotated, acts as a cam to raise or lower the bedbar. Identification dot on bolt head denotes offset of bolt. When dot is in up position (Fig. 9) left end of bedbar is raised. As bolt is turned clockwise and dot is lowered, so is left end of bedbar. Identification dot must be positioned within rear (180°) position when adjusting.

5. Rotate left hand (eccentric) pivot bolt to raise or lower bedbar as required.

6. Check adjustments by repeating steps 2 and 3.

7. After getting light contact on paper at each end of bedknife, tighten left hand jam nut while holding pivot bolt in position. Check to make sure pivot bolt did not get out of adjustment when turning jam nut. Adjust again if necessary.

NOTE: If the reel has worn so you cannot get the bedknife parallel to the reel by turning the eccentric bolt, the reel will require grinding to remove taper. The reel normally wears faster on the lead-in side, which results in the described taper.

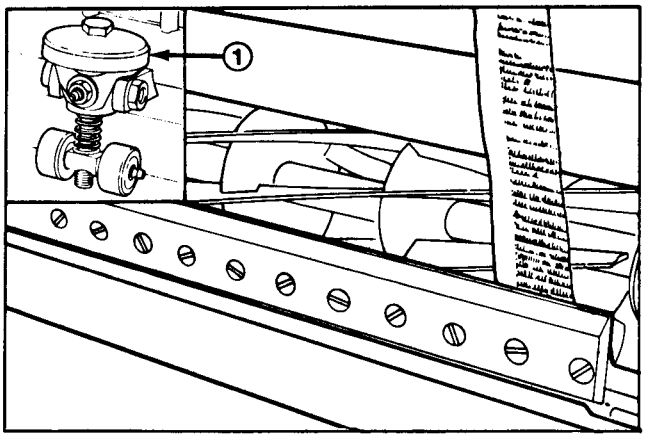


Figure 8

1. Bedknife adjusting knob

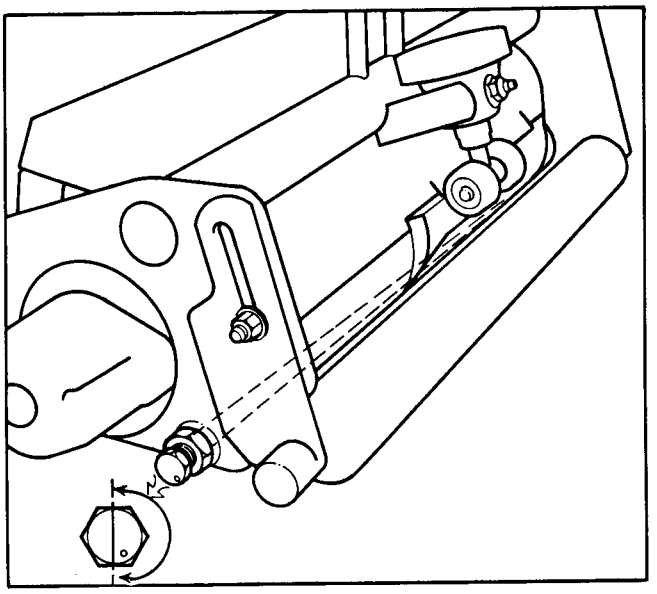


Figure 9

Leveling Rear Roller to Reel

1. Put cutting unit on a flat, level surface.

2. Assemble rear height of cut brackets to desired position, by loosening top capscrew and nut and removing bottom nut on right and left hand sides of cutting unit (Fig. 10).

3. Slide bolts thru each bracket until brackets can be realigned with appropriate mounting hole. See table for proper position on brackets.

NOTE: The different rear roller bracket positioning holes (B thru E) are designed to optimize bedknife location for different heights of cut.

Rear Roller Bracket Hole Position – 8 Blade Cutting Units
Height of cut 3/16 (.187) in. and below use the **B** position Height of cut 5/32 (.156) in. and above Use the **C** position Height of cut between 5/32 (.156) and 3/16 (.187) in., try **C** first; if not satisfactory, use **B** NOTE: For Height of Cut 5/32 (.156) in. and lower use 3/32 in. (tournament) bed knife. Tournament bed knife should not be necessary with the rear roller in the C position.
Rear Roller Bracket Hole Position – 11 Blade Cutting Units
Height of cut 3/16 (.187) in. and below use the **B** position Height of cut 5/32 (.156) in. and above Use the **C** position Height of cut between 5/32 (.156) and 3/16 (.187) in., try **B** first; if not satisfactory, use **C** NOTE: For Height of Cut 3/16 (.187) in. and lower use 3/32 in. (tournament) bed knife. Tournament bed knife should not be necessary with the rear roller in the C position.

NOTE: The "B" hole position normally is the best rear roller location for most low (3/32" - 1/8") cutting conditions.

It may be necessary to change from the above suggested ranges in certain turf conditions.

4. After putting bracket into correct height-of-cut hole position make sure right hand rear roller bracket capscrews are tightened securely (Fig. 11).

5. Left hand rear roller bracket capscrews are to be tightened only enough to remove excessive looseness in assembly, but allow bracket to slide freely on side plate.

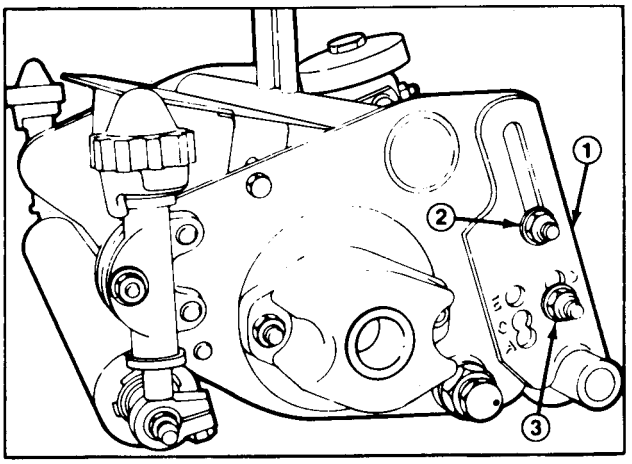


Figure 10

1. Rear height of cut bracket 3. Bottom nut
2. Top capscrew and nut

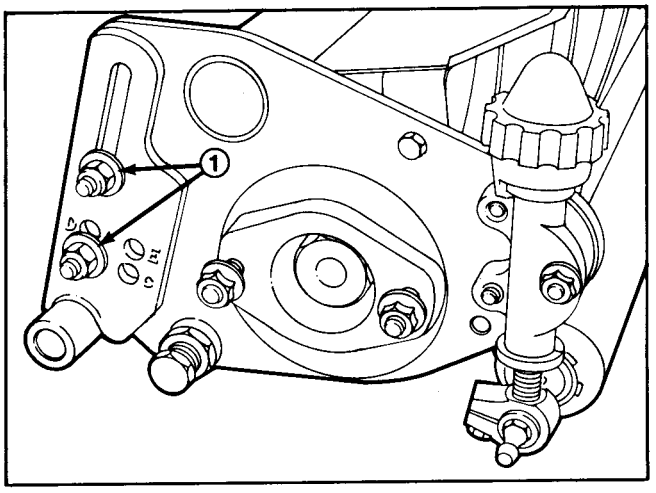


Figure 11

1. Right rear roller bracket capscrews

6. Position a 1/4 inch or thicker plate under the reel blades and against the front face of the bed-knife (Fig. 12).

NOTE: Make sure plate covers full length of reel blades, and (3) blades contact plate (8 blade reel).

7. While holding reel securely on plate, level roller by rotating lower left roller pivot bolt. The pivot bolt has an offset thread which when rotated, acts as a cam to raise or lower the roller. On the bolt head there is an identification dot (Fig. 13) which denotes the offset of the bolt. Dot indicates in which direction left end of roller moves when bolt is turned.

8. To verify if roller is level, try inserting a piece of paper under each end of roller.

9. When roller is level, tighten left capscrew and pivot bolt securely. Hold the eccentric pivot bolt while tightening the nut to keep the proper roller position.

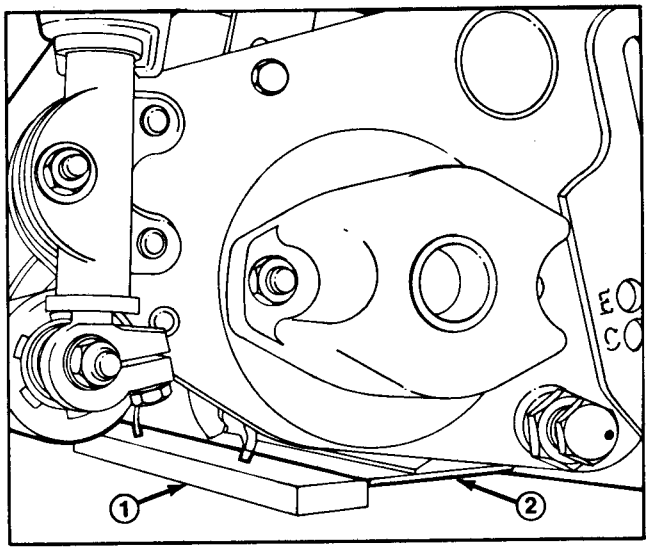


Figure 12

1. 1/4" plate
2. Bedknife

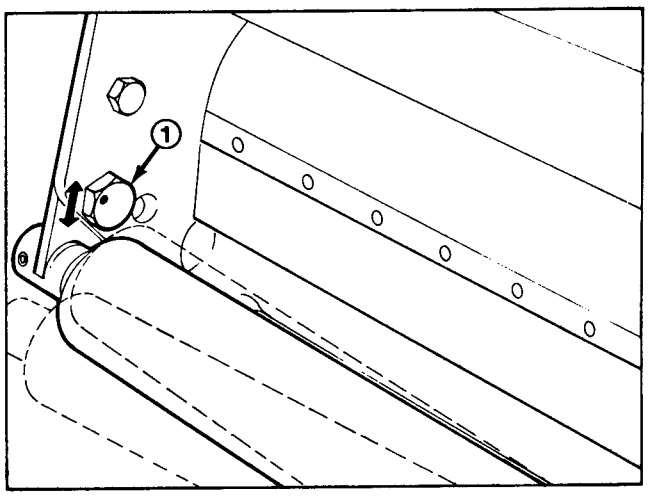


Figure 13

1. Pivot bolt

Height of Cut

Height of cut, as measured in the turf and on the cutting unit is different. The grass prevents the cutting unit from settling all the way to the ground line as the machine moves across the turf. Because of this, the actual (effective) height of cut is higher than the height of cut setting on the cutting unit (bench set height of cut) (Fig. 14).

Machine conditions, such as cutting unit weight, roller type, bedknife thickness, speed of travel and clip frequency, influence effective height of cut. Turf conditions, such as grass type, grass density, and amount of thatch also influence effective height of cut.

Changing the machine (such as adding a wiehle roller, or changing from a 4-bolt adjust cutting unit to a heavier single point adjust cutting unit) will increase penetration into the turf and lower the effective height of cut.

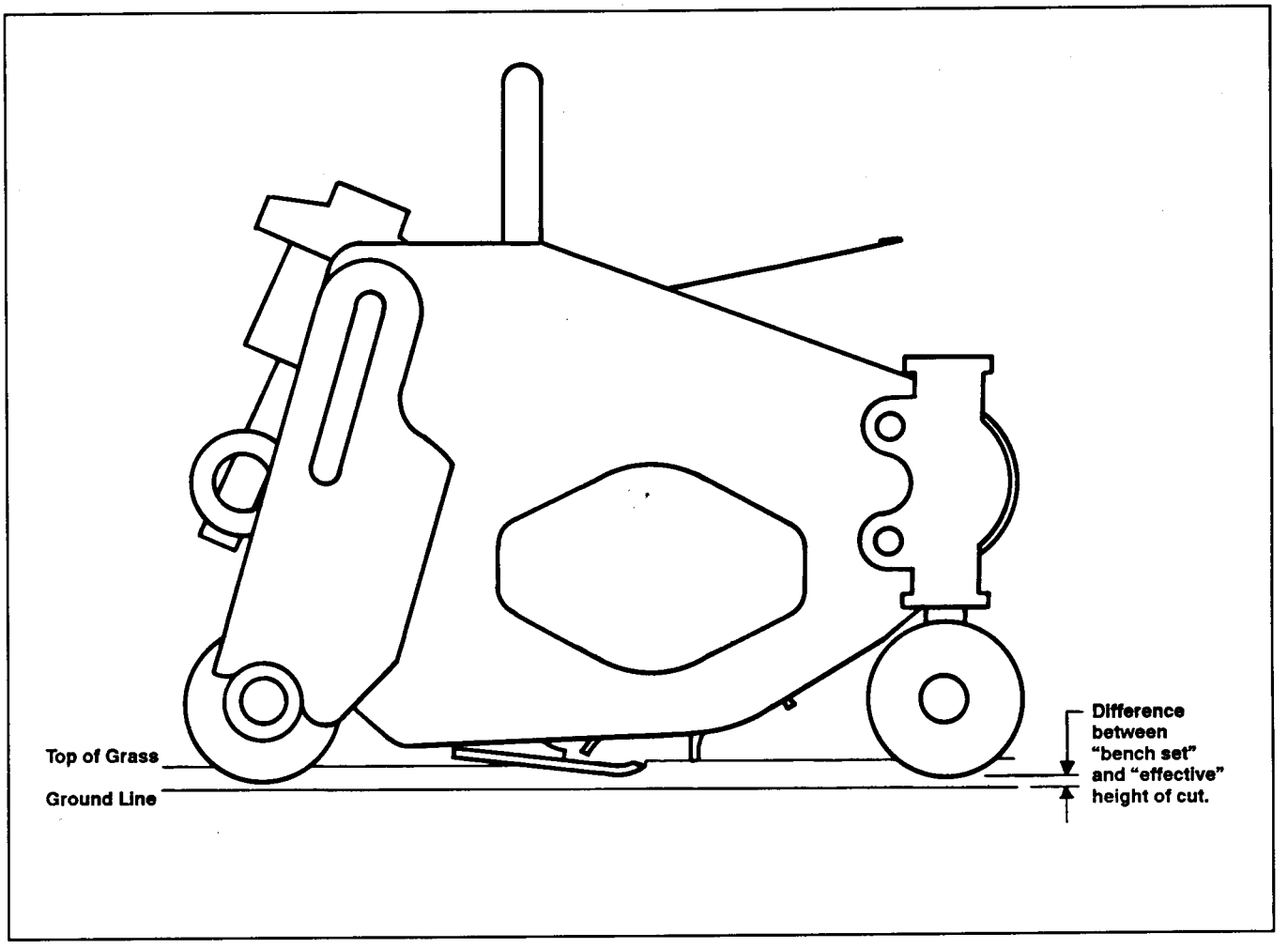


Figure 14

Height of Cut Adjustment

IMPORTANT: Lower heights of cut are limited by thickness of bedknife. Select proper bedknife for desired height of cut. If bedknife is too thick for height of cut, poor quality of cut will result and excessive pressure from turf on bottom of bedknife can cause "rifling" of bedknife and reel.

1. Make sure that rear roller brackets are in correct hole positions for desired height of cut and that rear roller is level. Also, check that bedknife to reel contact is correct.

2. Turn cutting unit over and loosen locknuts securing front roller adjusting screws to height of cut brackets (Fig. 15).

3. On gauge bar (Part No. 1-8789), set head of screw to desired height of cut. This measurement is from bar face to underside of screw head.

4. Place bar across front and rear rollers and adjust height of cut knob until underside of screw head engages bedknife cutting edge (Fig. 14). Check and adjust on each end of bedknife, then tighten height of cut adjustment locknuts on each end.

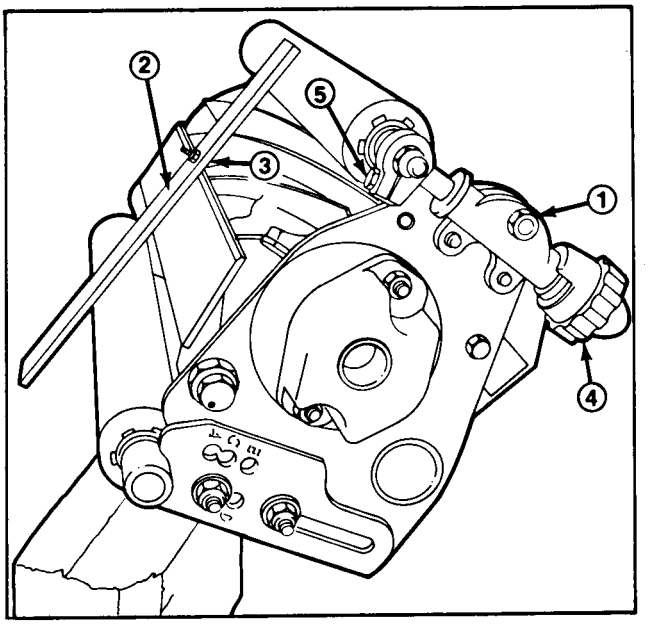


Figure 15

1. Height of cut knob locknut
2. Gauge bar (1-87891)
3. Gauge bar screw head
3. Height of cut knob
5. Roller shaft clamp bolt

Changing To A Different Type of Cutting Unit or Adding Cutting Unit Accessories

When changing to a different type of cutting unit or adding cutting unit accessories, it is recommended that you change only one cutting unit, and keep the other two existing cutting units on the machine.

1. Set the new cutting unit to a height of cut approximately 1/16 (0.06) in. higher than the old cutting unit.

2. Do a mowing test and compare results between the new cutting unit and old cutting units.

3. Adjust the new cutting unit to match the cut of the old cutting units.

4. The other two cutting units can now be replaced. Adjust these two new cutting units so they are the same as the other new cutting unit that was tested.

Front Roller Scraper Adjustment

The front roller scraper should be adjusted so there is a clearance of approximately 1/32 of an inch between the scraper and roller (Fig. 16).

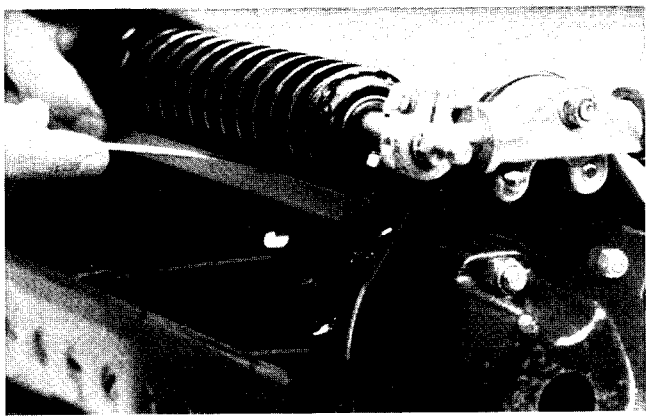


Figure 16

Comb Adjustment

1. Make sure rear roller is in the desired height of cut position. Loosen the bolts anchoring the front roller shaft (Fig. 17). Rotate the shaft.

2. To adjust the aggressiveness of the comb teeth (Fig. 17), proceed as follows:

   A. Teeth touching the adjusting gauge bar give an **aggressive** setting.

   B. Teeth midway between the adjusting gauge bar and the cutting edge of the bedknife give a **medium** setting.

   C. Teeth even with the cutting edge of the bedknife give a **light** setting.

NOTE: Securing one end of the comb assembly at a time simplifies the above procedure.

3. Tighten the roller shaft bolts.

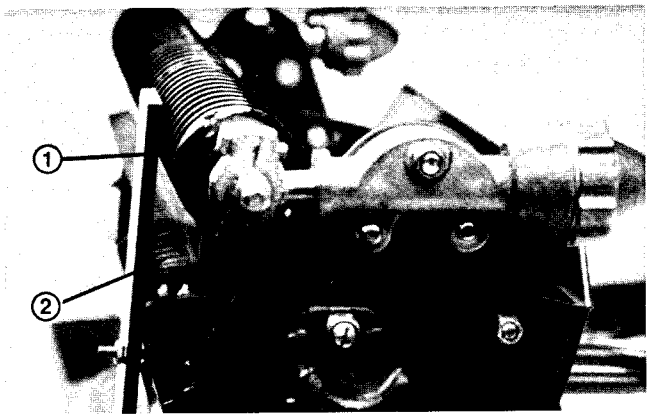


Figure 17

1. Roller shaft clamp bolt **2. Comb teeth**

Shield Height Adjustment

Adjust shield to get proper grass clipping discharge into basket:

1. Set cutting unit in normal cutting position and measure distance from top of front crossbar to shield at each end of cutting unit (Fig. 18).

2. Height of shield from crossbar for normal cutting conditions should be 4-3/4 inches. Loosen capscrews and nuts securing shield to each side plate, adjust shield to correct height and tighten fasteners (Fig. 18).

3. Repeat adjustment on remaining cutting units and adjust top bar. (See Adjusting Top Bar in this section of the book.)

NOTE: Shield can be lowered in dry grass conditions (clippings fall over top of baskets) or raised to allow for heavy wet grass conditions (clippings build up on rear edge of baskets).

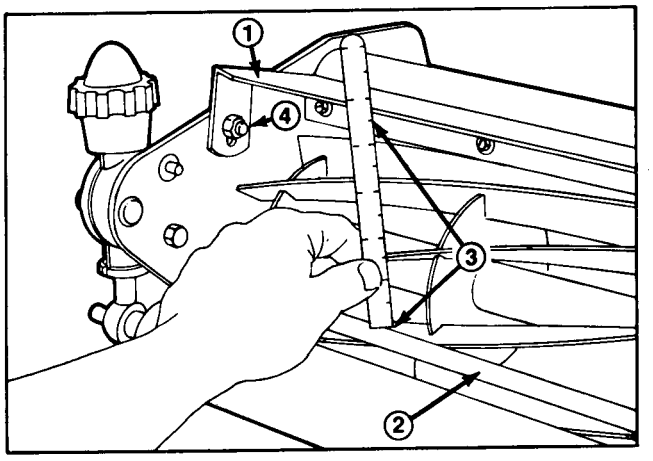


Figure 18

1. Shield
2. Front crossbar
3. 4-3/4 inches
4. Shield fasteners

Top (Cut-Off) Bar Adjustment

Adjust top bar to make sure clippings are cleanly discharged from reel area:

1. Loosen screws securing top bar (Fig. 19). Insert 0.060 inch feeler gauge between top of reel and bar and tighten screws. Make sure bar and reel are equal distance apart across complete reel.

2. Repeat settings on remaining cutting units.

NOTE: Bar is adjustable to compensate for changes in turf conditions. Bar should be adjusted closer to reel when turf is extremely wet. By contrast, adjust bar further away from reel when turf conditions are dry. Bar should be parallel to reel to get optimum performance and should be adjusted whenever shield height is adjusted or whenever reel is Sharpened on a reel grinder.

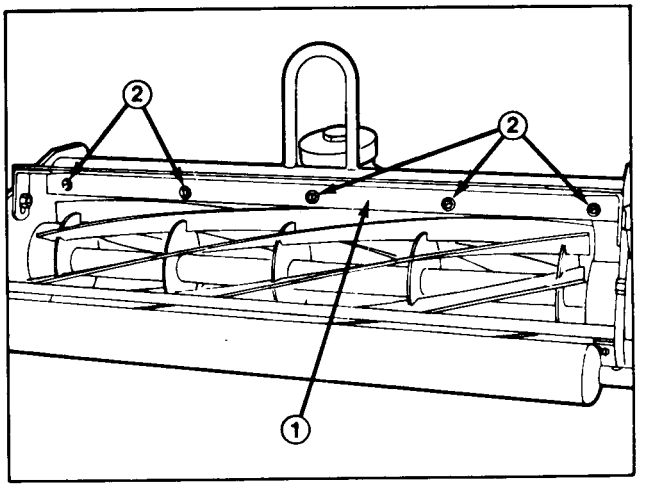


Figure 19

1. Top bar **2. Bar mounting screws**

Pull Frame Adjustment

1. Put the basket on the pull frame.

2. Level baskets to cutting unit by loosening nut at one end of pull frame roller. Loosen bolt and move roller shaft in slot as necessary. Tighten bolt.

3. Loosen the jam nuts on the pull arms and adjust the ball sockets until there is 1/4 in. to 1/2 in. (6 to 13 mm) clearance between the lip of the basket and the reel blades (Fig. 20). This prevents grass clippings from dropping on the ground.

4. Make sure the basket lips are the same distance from the reel blades at both ends of the reel. If the basket is too close to the reel, it is possible for the reel to contact the basket at the instant the cutting unit is raised off the ground.

5. Make sure each of the three (3) cutting units track straight with the traction unit:

A. On a smooth, level surface, draw a straight line on the floor (Fig. 20b). Push traction unit forward (removing slack from pull arms) so center of each front wheel is on top of the line. Use a plumb bob or square to make sure each wheel is centered on the line.

B. Measure from each end of cutting unit front roller to chalk line. Distance from each end of roller to line must be equal within 3/16 (0.187) in.

C. Loosen jam nuts on pull arms and adjust ball sockets so distance from each end of roller to line is within 3/16 (0.187) in.

NOTE: If a cutting unit cannot be adjusted to track correctly with the traction unit, the pull frame, or lift arm is damaged and/or the lift arm and pull frame bushings are worn and must be replaced.

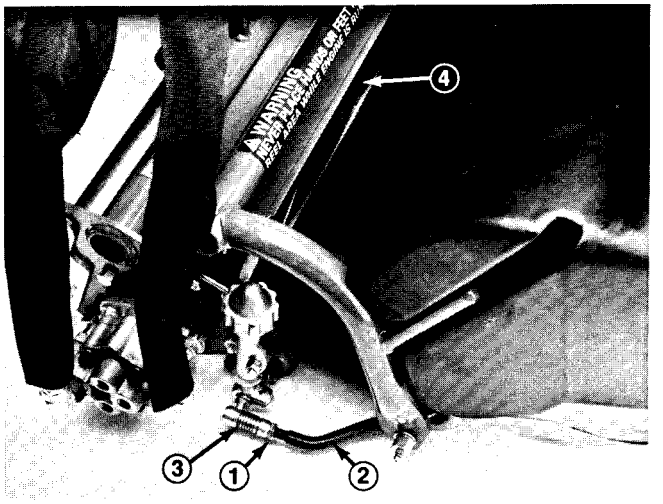


Figure 20a

1. Jam nut **3. Ball joint - adjust for clearance**
2. Pull arm **4. 1/4 - 1/2 in. (6 - 13 mm) clearance**

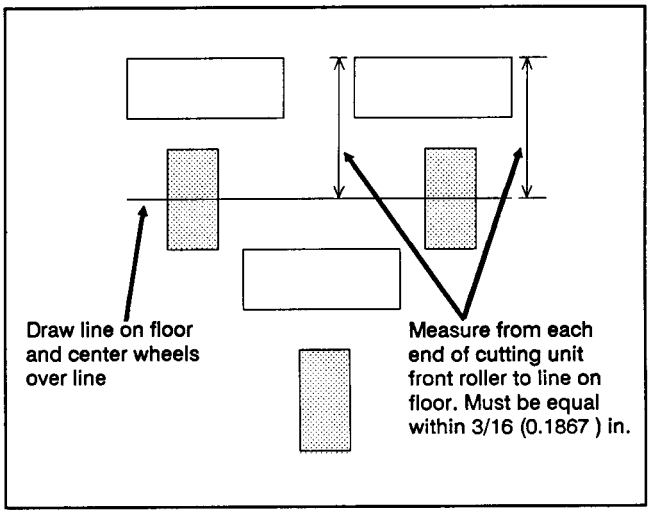


Figure 20b

Cutting Unit Removal and Installation

Remove cutting unit from traction unit before doing adjustments or repairs.

1. Remove basket from pull frame.

2. Loosen reel motor mounting nuts (Fig. 21). Rotate the motor clockwise so motor flanges clear studs and pull motor off of cutting unit.

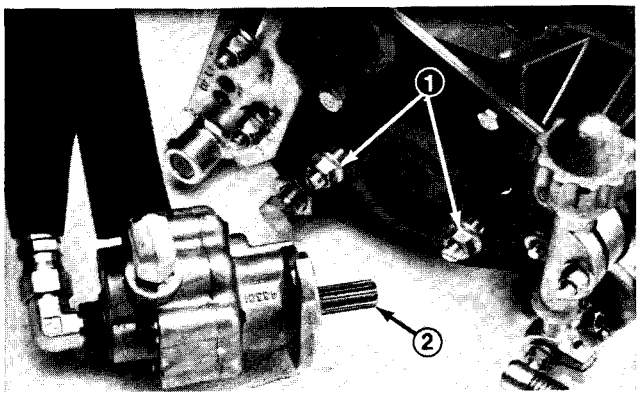


Figure 21

1. Motor mount nuts
2. Motor shaft

3. Slide the sleeve back on the ball joint and disconnect the pull arm from each side of the cutting unit (Fig. 22).

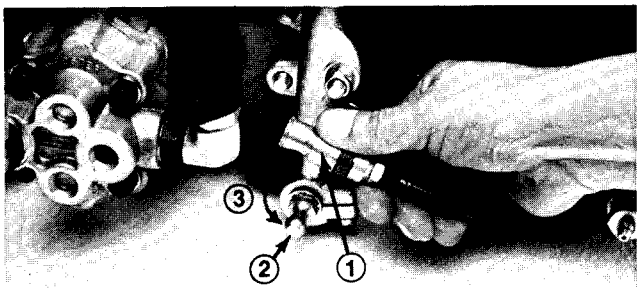


Figure 22

1. Slide back to mount
2. Ball stud
3. Swing up to remove, down to install

4. Slide cutting unit out from under pull frame, disengaging the lift arm from the lift bail (Fig. 23).

5. Reverse steps 1 - 4 to install the cutting unit.

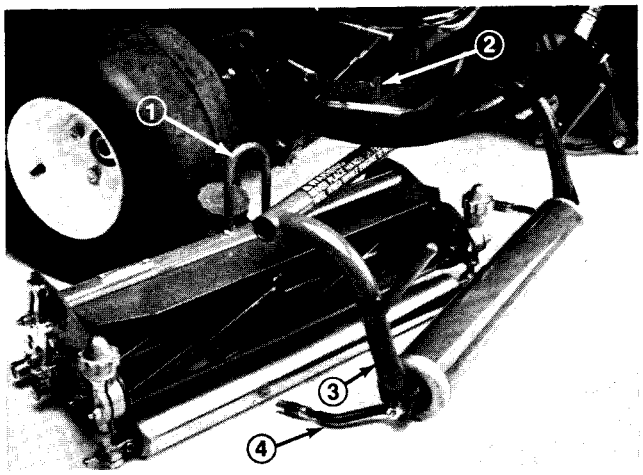


Figure 23

1. Lift bail
2. Lift arm
3. Pull frame
4. Pull arm

Reel Lapping

Check reel bearing adjustment and correct if necessary before backlapping. Connect lapping machine to cutting unit with an extension coupler, and a 9/16 in. socket. The 9/16 in. socket can be installed onto the capscrew on the reel shaft inside the counter-balance weight on the end of the cutting unit. Backlap according to procedures in the Toro publication "Sharpening Reel & Rotary Mowers" Form No. 80-300-PT.

NOTE: For a better cutting edge, run a file across front face of bedknife when lapping operation is completed. This will remove any burrs or rough edges that may have built up on the cutting edge.

CAUTION

Be careful when lapping the reel because contact with the reel or other moving parts can result in personal injury.

Bedbar Removal and Installation

1. Loosen pivot screws securing bedknife pivot assembly to reel frame supports (Fig. 24).

2. Rotate adjustment knob and pivot assembly clockwise (left hand thread) until it is unthreaded from bedbar pivot (Fig. 24).

3. Loosen jam nuts retaining right and left bedbar pivot bolts. Remove pivot bolts (Fig. 24).

IMPORTANT: Note position of plastic washer and steel washer on right end of bedbar, and plastic washer on left end of bedbar for reinstallation.

4. Slide bedbar down and out from under cutting unit. Do not misplace washers.

5. Replace and/or grind bedknife to renew cutting edges.

NOTE: For proper grinding of bedknife, follow procedures in the Toro publication, "Sharpening Reel and Rotary Mowers", Form No. 80-300-PT.

6. Adjust the reel bearings. (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter.)

7. Grind the reel to remove any taper and renew cutting edges. (See Preparing Cutting Unit for Reel Grinding in this section of the book.)

8. Check size of hole in bedbar end bushings every time bedbar is removed. Insert flange bushing into rubber bushing (Fig. 25). Insert clean shoulder bolt into flange bushing/rubber bushing assembly. If bolt slides easily into bushing, replace all four bedbar bushings. (See Bedbar Bushing Replacement in this section of the book.)

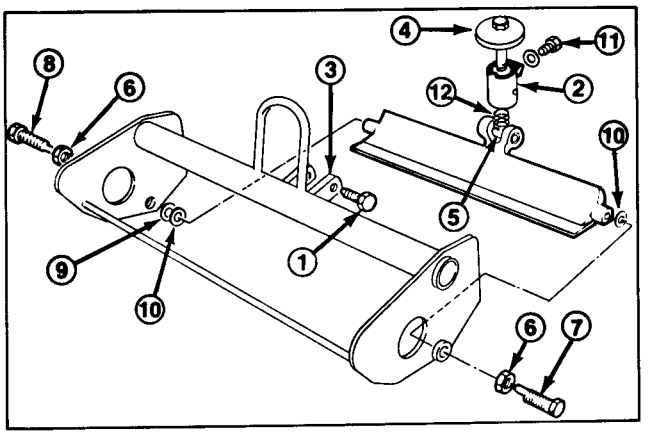


Figure 24

1. Pivot screw
2. Bedknife pivot ass'y
3. Frame supports
4. Adjustment knob
5. Bedbar pivot
6. Jam nuts
7. Left bedbar pivot bolt
8. Right bedbar pivot bolt
9. Steel washer
10. Plastic washer
11. Spring arm retaining capscrew
12. Compression spring

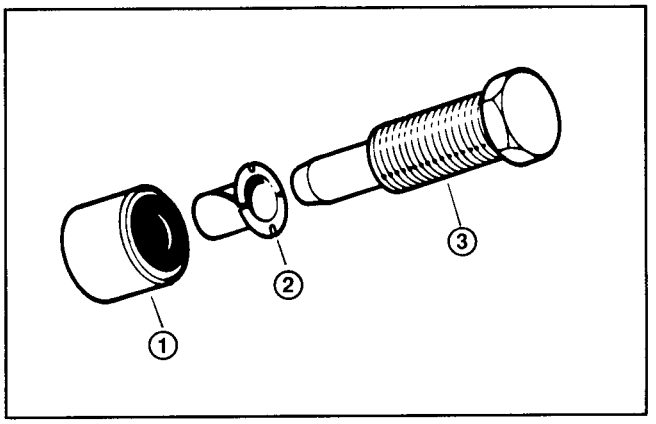


Figure 25

1. Rubber bushing
2. Flange bushing
3. Shoulder (pivot) bolt

9. With frame on level surface and pivot set screws installed, measure from flat surface up to end of each setscrew (Fig. 26). If not within 1/16 in. of each other, carefully bend frame supports to line up screws. Remove pivot set screws. Measure distance between frame pivot supports (Fig. 26). If dimension is not between 1-9/16 in. and 1-5/8 in., carefully bend supports until correct.

10. To install bedbar, slide it into into position between side plates, making sure each end of bedbar is under shield (Fig. 27).

IMPORTANT: Always use McLUBE (Toro Part No. 505-35) on bedbar pivot and pivot bolts.

11. Install jam nut on eccentric pivot bolt. Put plastic washer between left side of bedbar and side plate. Thread pivot bolt into side frame until distance from top of pivot bolt to side plate is 1-5/16 in. with identification dot toward the rear (Fig. 28). Do not tighten jam nut.

12. Install jam nut on straight pivot bolt. Put plastic washer and steel washer between right side of bedbar and side plate with plastic washer closest to bedbar. Thread pivot bolt into side plate. Adjust right-hand pivot bolt until left end of bedbar firmly seats against side plate, clamping the plastic washer snugly. This removes end-play from bedbar. Bedbar must pivot without binding. Hold right-hand pivot bolt to keep it from moving and tighten jam nut.

IMPORTANT: Apply NEVER-SEEZ or equivalent to the threads of the handle assembly.

13. Thread adjustment knob and pivot assembly into flat side of bedbar pivot (left-hand thread). Make sure there is an equal gap between each side of pivot assembly housing and frame supports (Fig. 29). Adjust (before installing pivot screws) by sliding bedbar pivot sideways.

IMPORTANT: On hand-adjustable type knobs, check to make sure die spring is compressed to 13/16 in. by tightening locknut (left-hand thread) (Fig. 6b).

14. If equipped with hex head type pivot screws, tighten pivot screws to 60 ft-lb. If equipped with hex socket head set screws and jam nuts, tighten set screws finger tight then tighten an additional 1/2 turn (total - not each). Tighten jam nuts.

15. Secure spring arm to pivot assembly. If spring arm is adjustable, adjust upward until a solid clicking sound is achieved when adjusting knob is turned.

16. Level bedknife to reel. Level rear roller to reel. Set height of cut. If necessary, backlap to get desired fit between reel and bedknife.

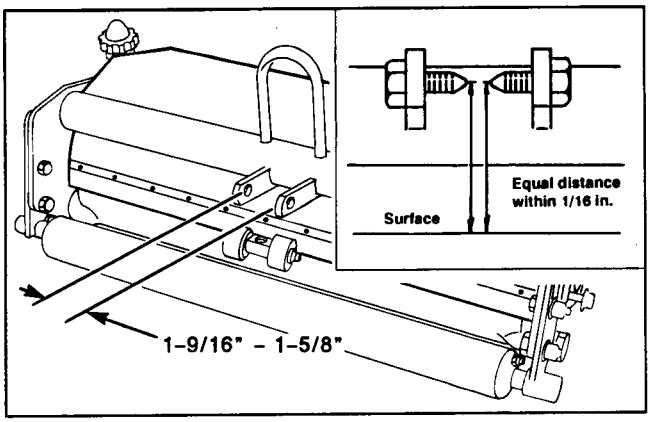


Figure 26

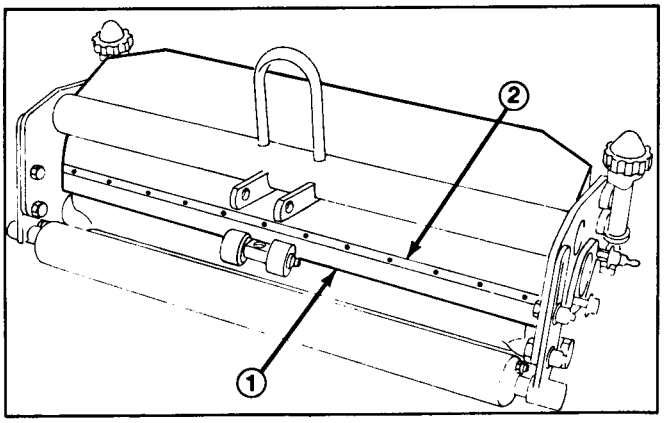


Figure 27

1. Bedbar 2. Shield

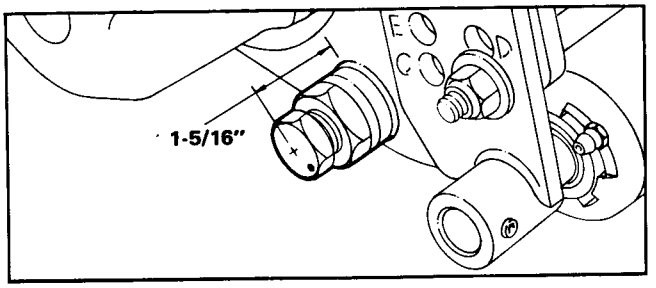


Figure 28

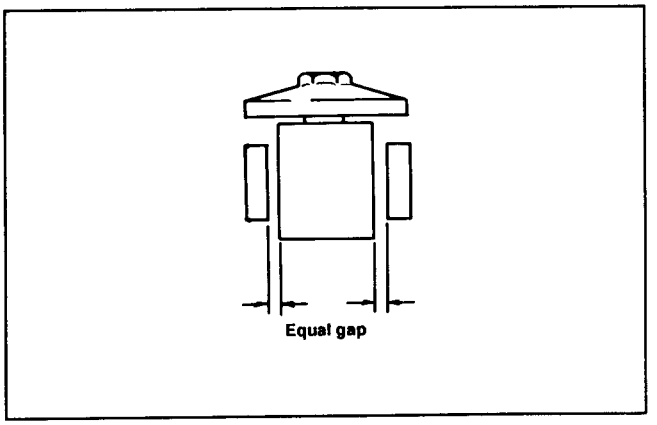


Figure 29

Bedbar Bushing Replacement

NOTE: Only after making sure that all normal cutting unit adjustments are correct, should the bushings be suspected as causing quality of cut problems.

The bedbar end bushings and pivot bushings (Fig. 30) contain rubber and are exposed to severe conditions. It is recommended to replace these bushings and the plastic flange bushings every two years.

1. Do steps 1 - 4 under Bedbar Removal and Installation in this section of the book.

2. Remove bedbar end bushings with a punch and hammer (Fig. 31). Alternate from one side to other on bushing (there are two slots in bedbar bushing boss).

IMPORTANT: Apply NEVER-SEEZ or equivalent to outside surface of bedbar end bushings and pivot bushings before installing in bedbar.

3. Press end bushings into bedbar far enough so plastic sleeve collar is below bedbar end face (Fig. 32).

NOTE: Bedbar end bushings have less rubber and more steel which is visible than bedbar pivot bushings. Do not use bedbar end bushings in the pivot area as they are too rigid.

4. Use an arbor press to remove bedbar pivot bushings (Fig. 33). DO NOT hammer on pivot boss of bedbar without support. You will break the casting.

5. Press center pivot bushings into place (Fig. 33). DO NOT hammer on pivot boss of bedbar without support. You will break the casting.

6. Do steps 5 - 16 under Bedbar Removal and Installation in this section of the book.

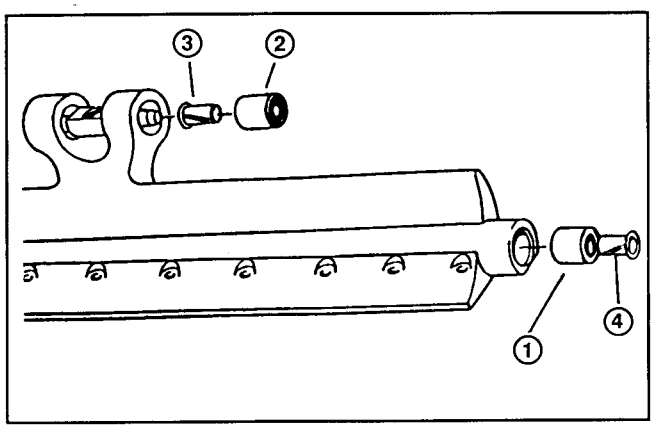


Figure 30

1. Bedbar end bushing (2)
2. Bedbar pivot bushing (2)
3. Flange bushing (4)

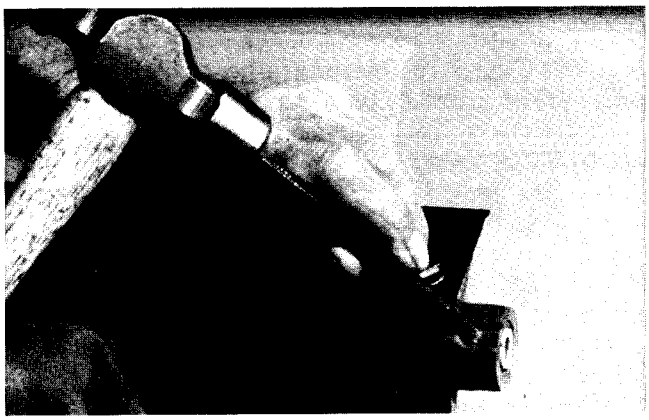


Figure 31

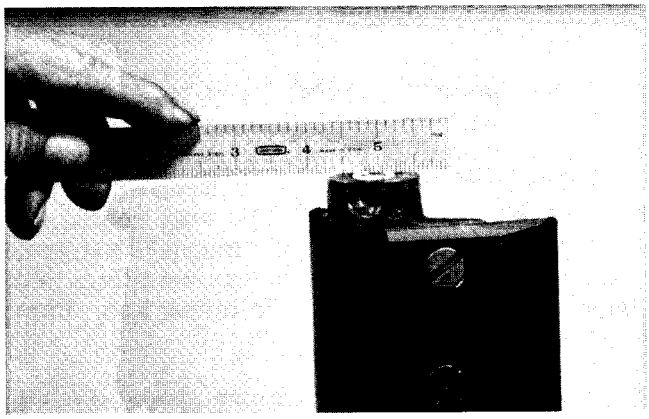


Figure 32

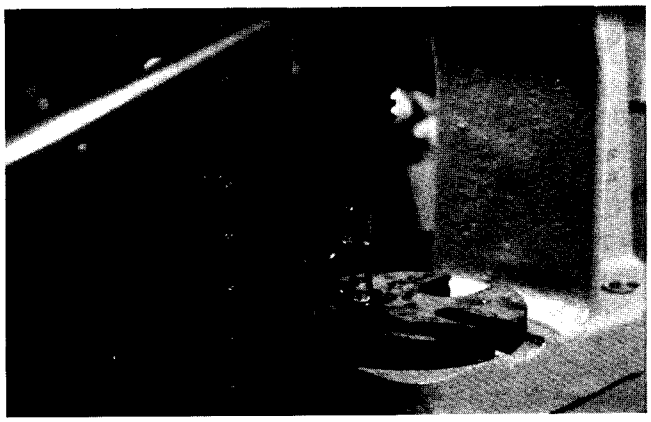


Figure 33

Bedknife Replacement

1. Do steps 1 - 4 under Bedbar Removal and Installation in this section of the book.

2. Remove bedknife screws and remove bedknife.

3. Remove all rust, scale and corrosion from bedbar surface before installing new bedknife.

4. Install new bedknife with the proper bedknife screws (57-4910). Bedknife screws must bottom out on bedknife, not bedbar. Tighten screws to a torque of 200 in-lb, working from the center toward each end of the bedbar (Fig. 34).

5. Grind new bedknife to match it to bedbar.

NOTE: For proper grinding of bedknife, follow procedures in the Toro publication "Sharpening Reel and Rotary Mowers", Form No. 80-300-PT..

6. Do steps 6 - 16 under Bedbar Removal and Installation in this section of the book.

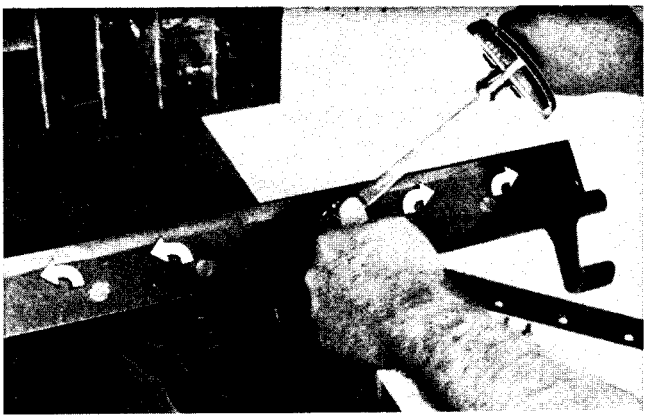


Figure 34

Preparing Cutting Unit for Reel Grinding

IMPORTANT: Adjust reel bearings before grinding reel. (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter

1. Do steps 1 - 6 under Bedbar Removal and Installation in this section of the book.

NOTE: Some reel grinders require rear roller assembly be mounted to cutting unit for proper support in reel grinder. Rear roller must be parallel to reel shaft to remove taper when grinding.

2. Raise or remove front roller assembly.

   A. Loosen locknuts securing height of cut adjusting rods at both ends of cutting unit and roller shaft clamp bolts (Fig. 35).

   B. Turn height of cut adjustment knobs to raise roller out of the way or remove roller if necessary (Fig. 35).

For proper grinding, follow procedures in Toro publication "Sharpening Reel and Rotary Mowers Form No. 80-300-PT.

3. Do steps 8 - 16 under Bedbar Removal and Installation in this section of the book. After grinding, assemble cutting unit, check bearing adjustment and adjust top shield and bar. Back lap if necessary to get desired fit between reel and bedknife.

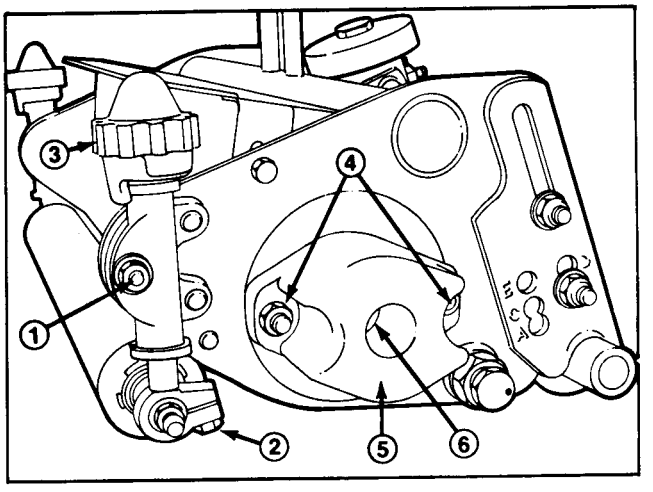


Figure 35

1. Height of cut locknut
2. Roller shaft clamp bolt
3. Height of cut knob
4. End cap mounting nuts
5. Counterbalance end cap
6. Reel bearing adjustment nut

Reel Removal and Bearing Replacement

1. Do steps 1 - 4 under Bedbar Removal and Installation in this section of the book.

2. Remove counterbalance end cap from left hand side of the cutting unit (Fig. 35). Remove large bearing adjustment nut from one end of reel shaft (Fig. 35) and special spline nut at opposite end of reel shaft.

3. Remove machine screws securing bearing housing on each end of cutting unit (Fig. 36). The machine screw heads will have to be cut off before the screw can be completely removed:

A. Unscrew machine screw approximately two turns.

B. Cut off machine screw head.

C. Back out remaining part of screw from side plate with a screw driver (outwards, not inwards towards reel). If machine screw does not have a screw driver slot, use a pliers to back out screw.

IMPORTANT: Remove grease fittings from bearing housing at each end of cutting unit. Note that the straight fitting is on the right end, and 90° fitting at the left end (when viewed in the direction of travel).

3. Use a soft face hammer to rotate bearing housing slightly. Install bolts from outside of housing and turn bolts alternately against side plate to remove bearing housing (Fig. 37). Bearing housing will slip out of side plates. Reel can be removed as soon as bearing housings are disassembled from side plates.

4. Before installing reel, install new special machine screws from inside of frame to secure bearing housings.

5. If necessary, install new bearings and seals:

A. Remove outer seal (in counterbalance weight), bearing cup, bearing cone and inner seal.

B. Bearing housing must be completely free of paint and foreign material before installing bearing cup. If necessary remove any "flash" from bearing housing that may interfere with accurate seating of bearing. Install new inner seal. Install bearing cup.

C. Install bearing housing to frame. Pack bearing cone with grease and install over reel shaft into bearing cup. Install new outer seal in counterbalance weight).

6. After installing reel, tighten spline nut to a torque of 40 to 60 ft-lb, then adjust bearings (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter.) **Use Loctite 271 on spline nut threads.**

7. Do steps 5 - 16 under Bedbar Removal and Installation in this section of the book.

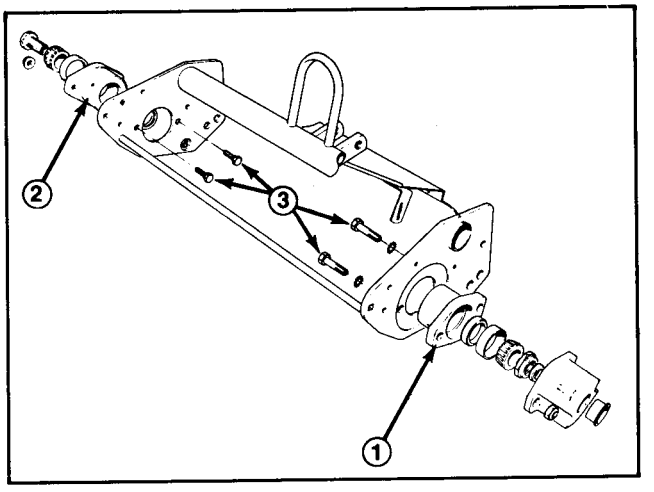


Figure 36

1. Left reel bearing housing
2. Right reel bearing housing
3. Machine screws

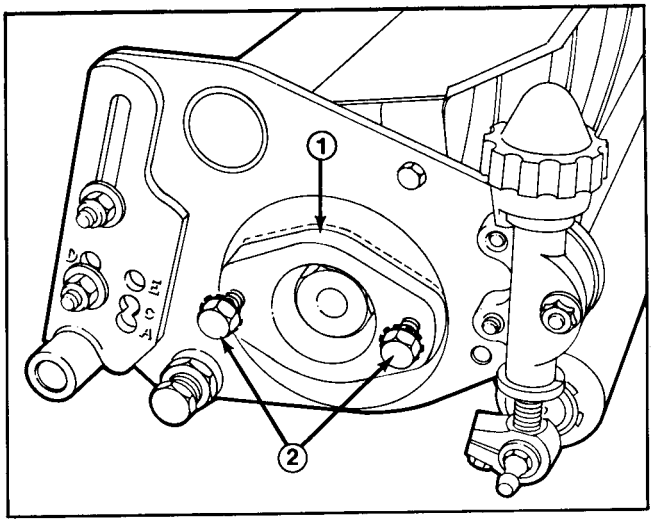


Figure 37

1. Bearing housing
2. Bolt

Bedknife Adjustment Knob Bearing Service

1. Turn bedknife adjustment knob counterclockwise to remove bedknife to reel contact.

2. Remove two (2) pivot screws (Fig. 38).

3. Rotate adjustment knob and pivot assembly clockwise (left-hand thread) until it is unthreaded from the bedbar pivot.

4. If necessary, remove locknut securing die spring to shaft (Fig. 6b). Slide pivot housing off adjustment knob threaded shaft (Fig. 38).

5. Pull inner races from pivot housing. Pull bearings from pivot housing. Check condition of inner races and bearings and replace if necessary.

6. Install new o-ring on each race if necessary.

7. Install bearings and races in pivot housing. Slide pivot housing onto shaft of knob.

8. Install spring over adjusting knob threaded shaft and thread adjustment knob and pivot assembly into flat side of bedbar pivot. Make sure there is an equal gap between each side of pivot assembly housing and frame supports (Fig. 29). Adjust (before installing pivot screws) by sliding bedbar pivot sideways.

IMPORTANT: On hand-adjustable type knobs, check to make sure die spring is compressed to a dimension of 13/16 in. by tightening locknut (left-hand thread) (Fig. 6b).

9. If equipped with hex head type pivot screws, tighten pivot screws to 60 ft-lb. If equipped with hex socket head set screws and jam nuts, tighten set screws finger tight then tighten 1/2 turn more (total - not each). Tighten jam nut.

10. Adjust bedknife to reel contact.

NOTE: If quality of cut has deteriorated or the reel and bedknife have become "rifled" , you must grind the reel and bedknife to remove rifle pattern.

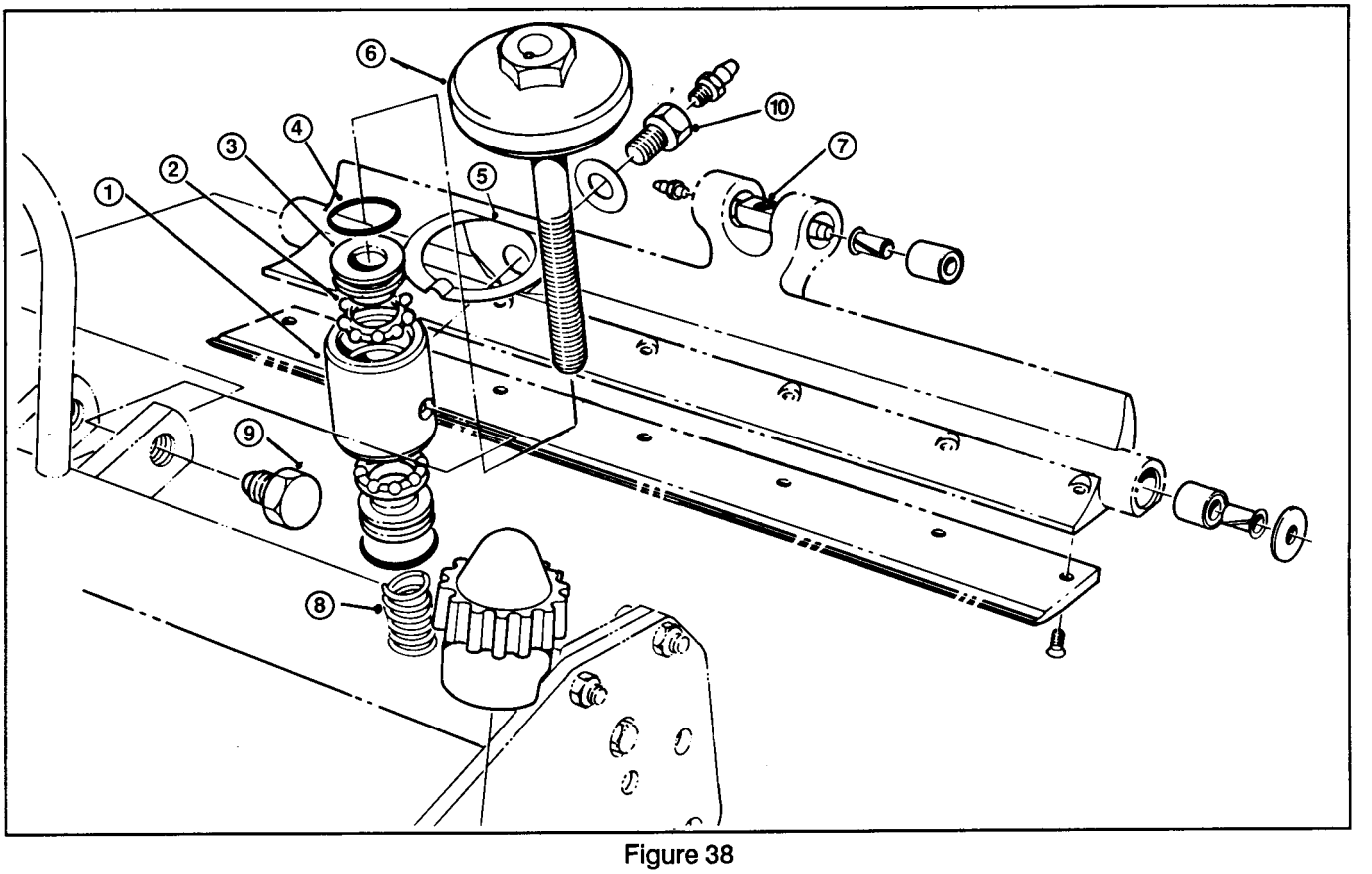


Figure 38

1. Pivot housing
2. Bearing (2)
3. Inner race (2)
4. O-ring (2)
5. Spring arm
6. Adjustment knob
7. Bedbar pivot
8. Spring
9. Pivot screw (2)
10. Spring arm bolt

Lift Bail Replacement

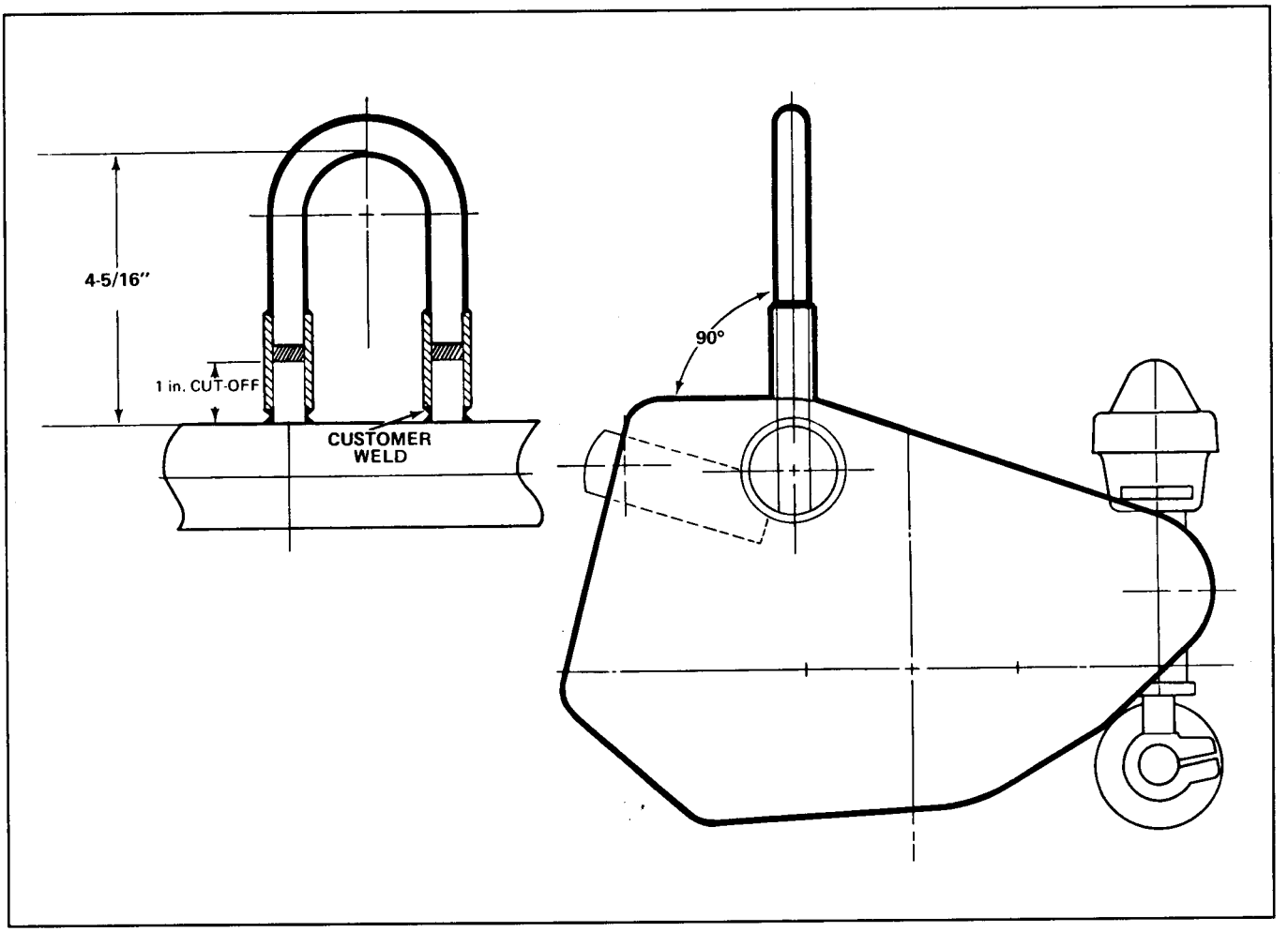


Figure 39

1. Use a saw to cut the lift bail off of the cutting unit. Make the cut 1 inch from the horizontal frame tube (Fig. 38).

2. Use a grinder to remove burrs from the stubs of the lift bail remaining on the cutting unit.

3. Install the repair lift bail (Part No. 71-1600).

4. Support the lift bail so the bottom radius is 4 5/16 inches from the top of the horizontal frame tube. Make sure the lift bail is square to the side frame.

5. Weld all around the bottom of the repair lift bail with mild steel rod, both sides.

Chapter 9

Grooming Reel Cutting Units

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Introduction

See **Chapter 7 - 4 Bolt Adjust Cutting Units** for specific information about 4 Bolt Adjust Cutting Units equipped with Grooming Reels. Specific information for 4-Bolt Adjust Cutting Units (i.e., bedknife to reel adjustment, bedbar removal and installation, and leveling rear roller to reel) is not covered in this chapter.

Specifications

Height Of Cut: 3/32 (0.094) in. to 3/4 (0.75) in.

Clip Frequency and Optimum Height of Cut Range:

Model No.	Clip (max.)	Optimum Height of Cut Range
04460 (8 blade reel):	0.25 in.	3/16" - 5/16"
04465 (11 blade reel):	0.18 in.	1/8" - 7/32"

Roller Adjustment:
Front: Micrometer hand adjustment with bolted clamp lock (1 turn 0.025 in. height of cut change).
Rear: Roller brackets allow adjustment for different height of cuts. Single screw adjustment for leveling.

Bedknife To Reel Adjustment: Bedknife adjusts against reel, with positive adjustment control knob located at center of bedbar. Adjustment knob contains detent with .001 inch movement of bed-knife for each indexed position..

Groomer Reel Depth: 0.18 in. maximum below height of cut

Groomer Reel Raised Height: 5/16 (0.312) in. from grooming reel height/depth adjustment.

Reel Speed: 1940 rpm (engine speed 2800 rpm).

Groomer Reel Speed: 3200 rpm.

Bedknife Screw Torque: 200 in-lb.

Reel Splined Drive Nut Torque: 40 to 60 ft-lb.

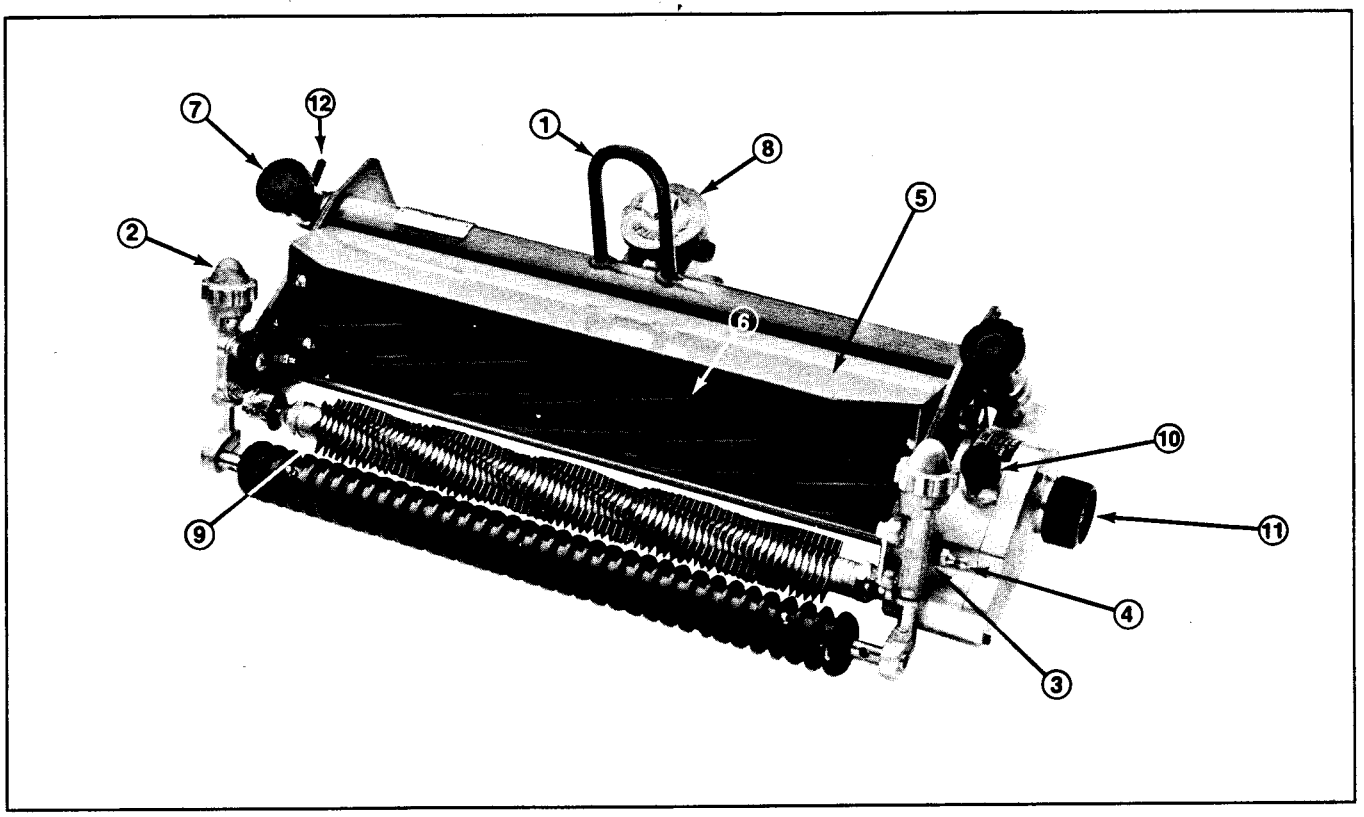
Reel Bearing Rolling Torque: 7 in-lb. maximum with bedknife to reel contact removed.

Front or Rear Roller Run-Out: 0.14 in. max.

Groomer Reel Drive Belt Tension: 1/4 in. deflection when a force of 5 - 10 lb. is applied midway between drive pulley and driven pulley.

Clutch Adapter Torque: 170 to 210 in-lb.

Clutch Assembly Locknut Torque: 140 in-lb (removing all end play).



1. Lift bail
2. Height of cut adjustment knob (2)
3. Height of cut adj. locknut (2)
4. Pull rod studs (2)
5. Grass shield
6. Reel
7. Groomer micro adj. locknut (2)
8. Bedknife adjustment knob
9. Groomer reel
10. Groomer clutch snubber
11. Clutch engage/disengage knob
12. Groomer quick up/down lever (2)

Special Tools

NOTE: Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*. Some tools may be listed in the Greensmaster 3000 or 3000-D Parts Catalog. Some tools may also be available from a local supplier.

McLube

Aerosol or liquid lubricant. Apply to bedbar pivot and bedbar pivot bolts.

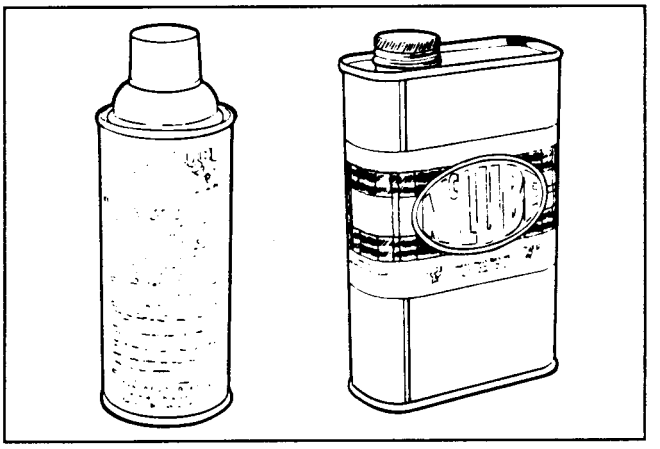


Figure 1

Roller Bearing Replacement Tool

Puller is used to remove bearings from front and rear rollers. Driving tubes are used to install bearings into rollers. Refer to instructions supplied with tool. Used on swaged, full and wiehle rollers.

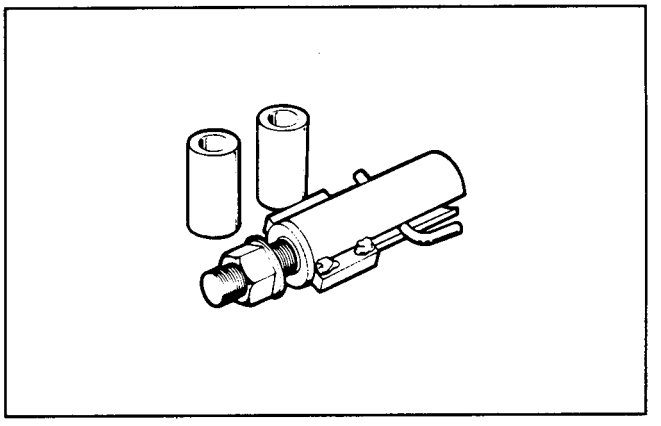


Figure 2

Plastic Plug

Insert plug in cutting unit bearing housing in place of reel motor when sharpening or grinding the reel.

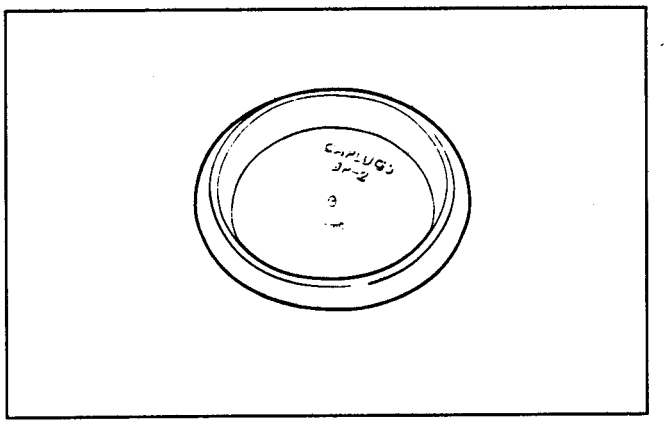


Figure 3

Handle Assembly

For applying lapping compound to cutting units while keeping hands a safe distance from the rotating reel assembly.

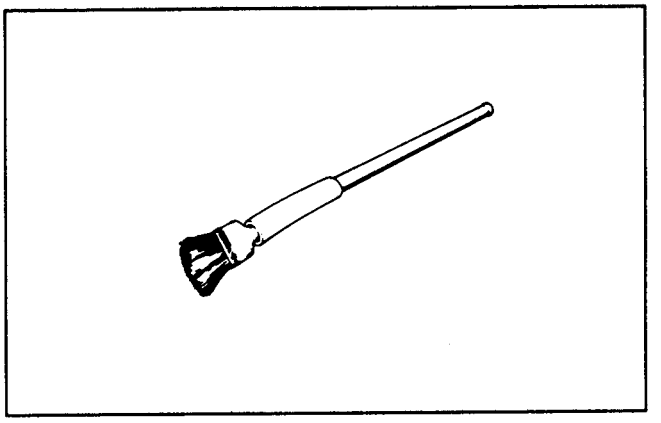


Figure 4

Bedknife Screw Tool

Fits Toro bedknife attaching screws. Use with torque wrench to secure bedknife to bedbar. With clean bedbar threads and new screws, tighten to a torque of 200 in-lb.

NOTE: Remove all rust, scale and corrosion from bedbar surface before installing bedknife.

DO NOT use an air impact wrench with this tool.

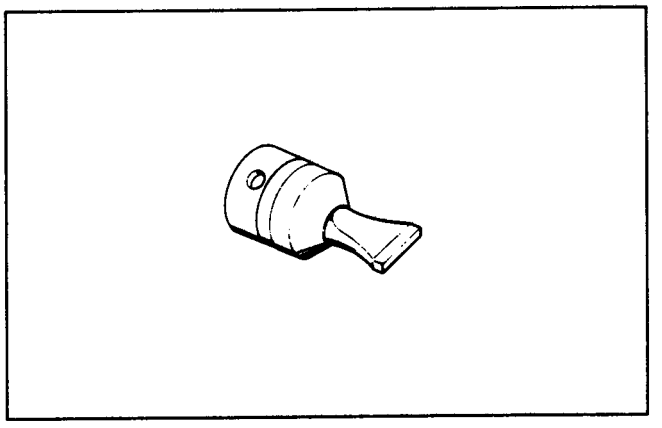


Figure 5

Factors Affecting Quality of Cut

There are a number of factors that can contribute to unsatisfactory quality of cut, some of which may be turf conditions. Turf conditions such as excessive thatch, "sponginess" or attempting to cut off too much grass height may not always be overcome by adjusting the machine. It is important to remember that the lower the height of cut, the more critical these factors are. See the Adjustments and Repairs sections for detailed adjustment and repair information.

Factor	Possible Problem/Correction
1. Tire pressure.	Check tire pressure adjust to specification if necessary. Must be equal in both front tires.
2. Engine governed speed.	Check maximum governed engine speed. Adjust if necessary – affects reel speed, traction speed and clip frequency.
3. Reel bearing condition/adjustment.	Check and adjust to specification. Replace bearings if worn or damaged. Bearing cones must be installed square to bearing housing - make sure there is no "flash", paint or other foreign material in housing before installing new bearing cone.
4. Reel and bedknife sharpness.	Reel and/or bedknife that has rounded edge cannot be corrected by tightening bedknife to reel contact. Grind reel to remove taper (cone shape) and/or rifling (grooved or ribbed appearance). Grind bedknife to sharpen and/or remove rifling. (Most common cause of rifling is bedknife to reel contact that is too tight.) NOTE: New bedknife must be ground after installing on bedbar to match bedknife to bedbar.
5. Bedknife parallel to reel.	Check and adjust as necessary.
6. Bedknife to reel contact.	Check before operating with cutting unit on ground. Rotate the reel backwards by hand. Turn adjusting knob one (1) click at a time until first contact between reel and bedknife is felt or heard, then tighten one (1) more click to get light contact. No contact will dull the cutting edges. Excessive contact accelerates wear.
7. Bedknife attitude (rear roller bracket hole position).	Set to recommendations in chart on Page 10 - 14.
8. Rear roller parallel to reel.	Check and adjust as necessary.
9. Height of cut.	All cutting units set at same height of cut. Set with front roller – must be equal at both ends of roller. Bench set height of cut and actual (effective) height of cut are different. Effective height of cut depends on cutting unit weight, cutting unit accessories and turf conditions.
10. Proper bedknife for height of cut.	If bedknife is too thick for effective height of cut, poor quality of cut will result.

Factor	Possible Problem/Correction
11. Stability and position of bedbar.	Make sure bedbar bolt plastic washers are snug against bedbar. Bedbar must pivot without binding. Check bedbar end bushings and pivot bushings for wear or damage and replace if necessary. Make sure proper bushings are installed in each location (bedbar end bushings are different from pivot bushings). Check adjustment knob to make sure detent holds adjustment. Repair if necessary. With adj. knob/pivot assembly removed, pivot screws installed, and frame on level surface, measure from flat surface up to end of each setscrew. If not within 1/16 in. of each other, bend ears on cutting unit frame to line up screws. Check to make sure adj. knob/pivot assembly is centered in bedbar arm yoke and frame ears so that an equal gap exists on each side of pivot housing before pivot screws are installed. Make sure bedknife adj. knob/pivot assembly is held firmly in place between frame supports.Tighten pivot screws if necessary.
12. Number of reel blades.	Use cutting unit model with correct number of blades for clip frequency and optimum height of cut range. (Variable speed traction kit can be used to adjust clip frequency.)
13. Cutting unit alignment and pull frame ground following.	Check pull frame alignment on all cutting units. Adjust or repair as necessary. Check pull frames and lift arms for damage, binding and bushing wear. Repair if necessary.
14. Roller condition	All rollers must rotate freely. Grease when needed or repair bearings if necessary.
15. Reel speed.	All reels must rotate at same speed (within 100 rpm). All cutting units must have equal bedknife to reel contact and reel bearing adjustment before checking. Do not run the reel to long or it may get hot and rifle when no grass is being cut. See Troubleshooting in Chapter 5 - Hydraulic System.
16. Traction speed.	Check maximum governed engine speed. Adjust to specification if necessary. See Troubleshooting in Chapter 5 - Hydraulic System Install Variable Speed Traction Kit if necessary to control traction speed in varying conditions or with different attachments. Will allow change in traction speed while maintaining full engine rpm and reel motor rpm.
17. Cutting drop speed and sequence.	Center cutting unit must drop after front cutting unit. (See Troubleshooting in Chapter 5 - Hydraulic System.

Factors Affecting Grooming

There are a number of factors that can affect the performance of grooming. These factors vary for different golf courses and from green to green on the same golf course. It is important to inspect the turf frequently and vary the grooming practice with the need.

It is important to remember that Factors Affecting Quality of Cut also affect grooming performance.

IMPORTANT: Improper or over-aggressive use of the groomer reel (i.e., too deep or too frequent grooming) may cause unnecessary stress on the turf, leading to severe turf damage. Use the groomer cautiously. READ AND UNDERSTAND THE OPERATOR'S MANUAL BEFORE OPERATING OR TESTING GROOMER PERFORMANCE.

Variables That Affect The Use and Performance of Grooming Reels:

1. Time or year (i.e., growing season) and weather patterns.

2. General turf conditions.

3. Frequency of grooming/cutting - how many cuttings per week and how many passes per cutting.

4. Grooming reel blade spacing.

5. Height of cut. NOTE: Because of weight difference, "bench set height of cut" should be approximately 0.020 to 0.040 in. higher on groomer equipped cutting units to get the same "effective height of cut" as cutting units without groomer reels.

6. Grooming depth.

7. How long grooming reel has been in use on a particular turf area.

8. Type of grass.

9. Overall turf management program (i.e., irrigation, fertilizing, weed, disease and pest control, coring, overseeding, sand dressing, etc.).

10. Amount of traffic on turf.

11. Stress periods for turf (i.e., high temperatures, high humidity, unusually high traffic).

Grooming Reel Mechanical Problems

Problem	Possible Cause/Correction
1. Groomer rotates when in raised position with clutch disengaged.	Normal condition - the groomer may still rotate in raised position (with minimal force) when clutch disengaged because of friction in the clutch assembly. This condition may change over a period of time. Clutch not fully disengaged. Make sure clutch knob set screws are tight against flats on release disk and does not allow knob to slip. IMPORTANT: When engaging or disengaging clutch, be sure to push snubber down and turn knob all the way (will come to a firm stop) Clutch pulley bearing seized. Replace bearing. Clutch damaged or assembled incorrectly. Repair or replace clutch if necessary.
2. Clutch is engaged but does not provide power to groomer reel.	Clutch not fully engaged. Make sure clutch knob set screws are tight against flats on release disk and does not allow knob to slip. IMPORTANT: When engaging or disengaging the clutch, be sure to push the snubber down and turn the knob all the way (it will come to a firm stop) Clutch damaged or assembled incorrectly. Repair or replace clutch if necessary. Belt is out of adjustment. If belt has slipped. it will probably be damaged and must be replaced. Belt broken or damaged. Repair or replace belt if necessary. A broken or worn belt could be the result of improper belt adjustment or seized groomer reel bearings.
3. Turf damage or uneven grooming.	Bent, damaged or missing groomer blades. Replace blades if necessary. Bent or damaged groomer reel shaft. Replace groomer shaft. Grooming depth not equal on both ends of groomer reel. Adjust if necessary. Check and adjust cutting unit set up (level bedknife to reel, level rear roller to reel, set height of cut, etc.)
4. Groomer reel does not raise completely to transport position – quick-up levers do not rotate completely to rear or have free play.	Groomer reel interfering with cutting unit frame side plate. Check side plate for proper cut-out and modify if necessary. Incorrect front roller extension plate installed. Single Point Adjust and 4-Bolt Adjust cutting units require different front roller extension plates.

Set Up and Adjustments

Adjustment Summary and Check List

DETAILED ADJUSTMENT INSTRUCTIONS FOLLOW THIS SUMMARY AND CHECK LIST. Study this information and refer to it often for maximum life and performance of cutting units.

Daily Performance Checks

NOTE: It is not necessary to remove the cutting units from the traction unit to perform these daily checks. It is recommended that mowers be washed after each use. Always remove key from ignition switch when working on the machine.

1. Purge all water and debris from all bearings by greasing them. Use No. 2 multi-purpose lithium base grease.

2. Visually check for sharp reel and bedknife.

- Remove burrs, nicks, and rounded edges.

3. Visually check groomer reel for wear and damage.

- Straighten bent blades.
- Replace worn blades or reverse groomer reel to put sharpest blade edge forward.
- Make sure right and left shaft end nuts are tight.

4. Lower cutting units to the ground (setting on both rollers) and remove reel motor. Rotate the reel by hand. TURN ADJUSTING KNOB ONE (1) CLICK AT A TIME UNTIL FIRST CONTACT BETWEEN REEL AND BEDKNIFE IS FELT AND HEARD THEN TIGHTEN ONE (1) MORE CLICK TO GET LIGHT CONTACT *.

- No contact will dull the cutting edges.
- Excessive contact accelerates wear; quality of cut may be adversely affected.

* It is best to make the reel to bedknife adjustment in the morning, immediately before each day of mowing.

Weekly Checks

1. Check reel bearing adjustment and bearing condition.

2. Make sure bed bar bolt "plastic washers" are SNUG against the bedbar.

3. Make sure bedknife adjustment knob/pivot assembly is held FIRMLY in place between frame supports.

4. Use a gauge bar to check height of cut setting.

5. Use a gauge bar to check groomer depth setting.

Monthly Adjustments

NOTE: Remove cutting unit from traction unit.

1. Parallel bedknife to reel.

- Use newspaper as a feeler gauge.
- Dot on eccentric bolt must face rear of mower.
- Turn bedknife adjustment knob to hold paper on right-hand end of bedknife.
- Turn eccentric (left) bedbar bolt to hold paper on left-hand end of bedknife.
- Hold eccentric bedbar bolt while securing locknut.

2. Adjust rear roller parallel to reel; eccentric bolt faces to rear.

3. Check grass shield adjustment.

- 4-3/4 in. from crossbar - normal.
- Dry grass - lower shield.
- Wet grass - raise shield.

4. Set top bar (cut-off bar) adjustment.

- 0.060 in. from reel - normal.

5. Set cutting unit on ground (setting on both rollers) and remove reel motor. Adjust bedknife to reel contact.

6. Use a gauge bar to check height of cut and adjust as necessary.

7. Use a gauge bare to check groomer depth and adjust as necessary.

Special Notes

1. Replace bedbar bushings and nylon flange bushings every two years.

2. A "rifled" reel and/or bedknife must be corrected by grinding.

3. After extended running, notches will develop at both ends of bedknife. These notches must be rounded off or filed flush with cutting edge of bedknife to assure smooth operation.

4. If reel bearings will not hold adjustment during operation, loosen adjustment nut, tighten reel shaft *spline nut* on right hand end of reel shaft to a torque of 40 to 60 ft-lb., then adjust reel bearings.

Bedknife to Reel Contact

NOTE: The single knob bedknife-to-reel adjustment system simplifies the adjustment procedure needed to deliver optimum mowing performance. The precise adjustment possible with the single knob/bedbar design gives the necessary control to provide a continual self-sharpening action – thus maintaining sharp cutting edges, assuring good quality-of-cut, and greatly reducing the need for routine backlapping. In addition, the rear roller positioning system permits optimum bedknife attitude and location for varying heights-of-cut and turf conditions.

IMPORTANT: Bedknife to reel contact must be checked and adjusted every day even though quality of cut is acceptable.

1. Shut off engine and lower cutting units to ground. Remove the key.

2. Remove grass baskets.

3. Make sure the groomer reel is in the raised position. Raise the groomer reel by rotating the right and left quick up levers so they face to the rear (Fig. 6.)

4. Make sure the groomer reel is disengaged. Push the clutch snubber down and turn the clutch knob clockwise to disengage the clutch (Fig. 6).

IMPORTANT: When engaging or disengaging the clutch, be sure to turn the knob all the way (it will come to a firm stop). Failure to do so could cause damage to the clutch.

5. On each cutting unit, loosen (2) flange nuts securing reel motor to cutting unit. Twist motor clockwise to disengage from cutting unit and remove motor.

6. Slowly rotate reel, listening for reel-to-bedknife contact. If no contact is evident, TURN BEDKNIFE ADJUSTING KNOB CLOCKWISE, ONE (1) CLICK AT A TIME, UNTIL FIRST CONTACT IS FELT AND HEARD, THEN TIGHTEN ONE (1) MORE CLICK TO GET LIGHT CONTACT (Fig. 7).

7. If contact is felt, turn bedknife adjusting knob counterclockwise, one (1) click at a time until no contact is evident. Turn bedknife adjusting knob one (1) click at a time clockwise, until first contact is felt and heard, then tighten one (1) more click to get light contact.

8. Install hydraulic motor to cutting unit.

IMPORTANT: LIGHT CONTACT MUST BE MAINTAINED AT ALL TIMES. If light contact is not maintained, bedknife and reel edges will not self-sharpen sufficiently. This will result in dull cutting edges after a period of operation. If excessive contact is maintained bedknife/reel wear will be accelerated. Uneven wear can result, and quality of cut may be adversely affected.

NOTE: As the reel blades continue to run against the bedknife a slight burr will appear on the front cutting edge surface the full length of the bedknife. If a file is occasionally run across the front edge to remove this burr, improved cutting performance can be obtained.

NOTE: After extended operation, notches will eventually develop at both ends of the bedknife. These notches must be rounded off or filed flush with cutting edge of bedknife to assure smooth operation.

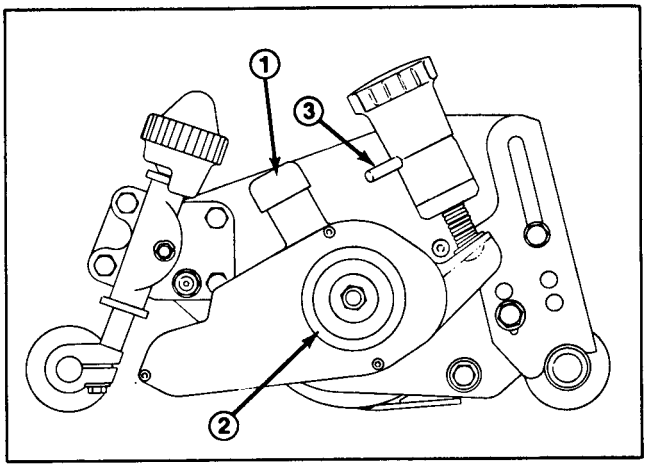


Figure 6

1. Clutch snubber
2. Clutch knob
3. Quick up lever (2)

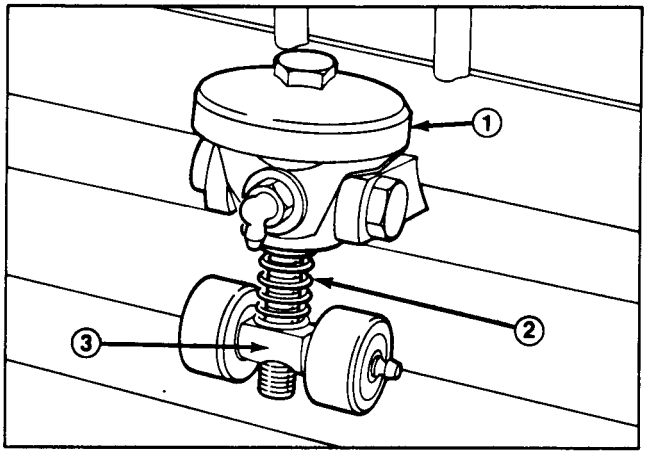


Figure 7

1. Bedknife adjusting knob
2. Compression spring
3. Pivot bar

Reel Bearing Service and Adjustment

1. Remove bedknife to reel contact by turning bedknife adjustment knob counterclockwise (Fig. 7).

2. Loosen two (2) set screws and remove clutch knob (Fig. 6). Remove groomer reel housing cover from left side of cutting unit (Fig. 8). Loosen idler pulley and remove drive belt. (Fig. 9).

3. Reel bearing rolling torque should not exceed 7 in-lb. Measure with a torque wrench at the spline nut on the right-hand end of the reel shaft.

NOTE: If bearing drag does not meet above specification or if you do not have an inch-pound torque wrench, do remaining steps in this procedure.

4. Remove nut and washer from clutch adapter shaft. Pull clutch assembly off adapter shaft (Fig. 9). Remove clutch adapter from reel shaft (Fig. 10).

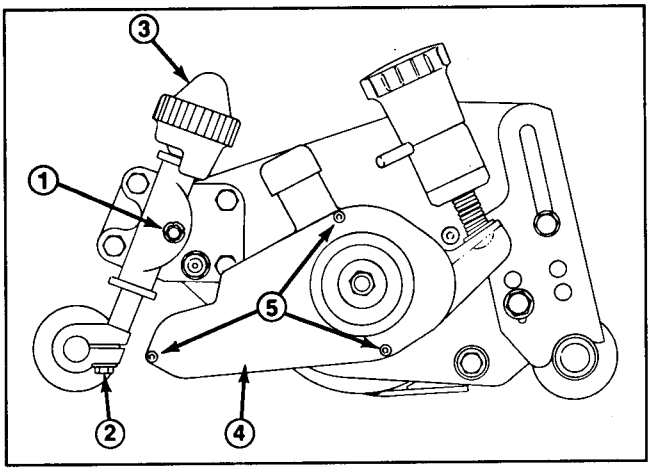


Figure 8

1. Height of cut locknut
2. Roller shaft clamp bolt
3. Height of cut knob
4. Grooming reel cover
5. Cover screws & washers

CAUTION

Do not use your hand to prevent reel from turning while servicing; this can result in personal injury. Use a 1/2 in. thick x 3 in. wide x 8 in. long piece of hardwood inserted into front of cutting unit between reel blades.

NOTE: If reel bearings will not hold adjustment during operation, loosen adjustment nut, tighten reel shaft *spline nut* on right hand end of reel shaft to a torque of 40 to 60 ft-lb, then adjust reel bearings. **Use Loctite 271 on spline nut threads.**

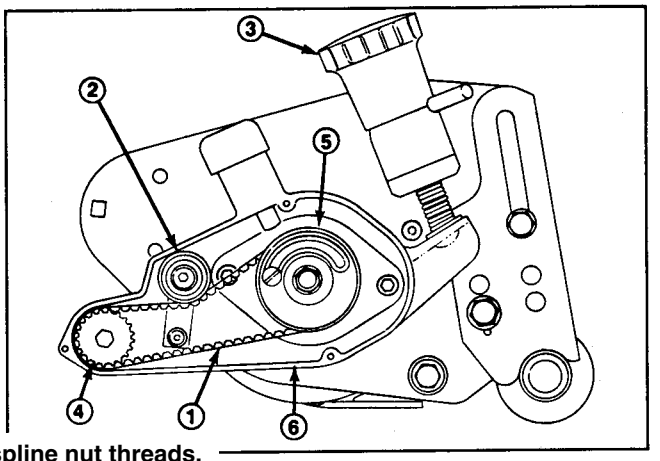


Figure 9

1. Drive belt
2. Drive belt idler pulley
3. Grooming reel adjustment knob assembly
4. Groomer driven pulley
5. Clutch assembly
6. Groomer reel housing

5. Loosen large reel bearing adjustment nut (Fig. 10). Tighten nut until all reel shaft end play is removed, then tighten an additional 1/16 to 1/8 turn. Be certain to remove all end play, but do not over-tighten. Rolling torque should not exceed 7 in-lb.

NOTE: Adjustment nut must have enough resistance against reel shaft threads to retain bearing adjustment. Replace adjustment nut if necessary.

6. If bearings require replacement, see Reel Removal and Bearing Replacement in the Repairs section of this chapter.

7. Install clutch adapter on reel shaft (Fig. 10) and tighten to a torque of 170 - 210 in-lb.

8. Hold belt on drive pulley and slide clutch on clutch adapter while sliding belt on driven pulley. Install washer and nut (removed in step 4) on clutch adapter shaft and tighten nut to a torque of 7 - 10 ft-lb. Adjust drive belt tension before installing cover. (See Groomer Reel Drive Belt Adjustment in this section of the book.)

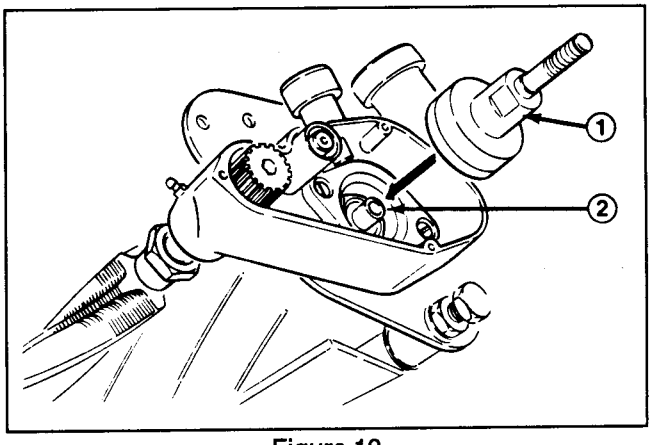


Figure 10

1. Clutch adapter shaft
2. Reel shaft and bearing adjustment nut

Parallel Bedknife to Reel

1. Remove mower from traction unit and put on a level work surface. Make sure reel contact is removed by turning bedknife adjustment knob counterclockwise.

2. On right-hand end of reel, insert a long strip of newspaper between the reel and bedknife. While slowly rotating reel forward, turn bedknife adjusting knob (Fig. 11) clockwise, one click at a time, until paper is pinched lightly resulting in a slight drag when paper is pulled.

3. Check for light contact at other end of reel using paper. If light contact is not evident at both ends, bedknife is not parallel to reel, proceed to step 4.

4. Loosen jam nut on left hand bedbar pivot bolt so bolt can be turned. Left hand pivot bolt (eccentric bolt) has offset thread which, when rotated, acts as a cam to raise or lower the bedbar. Identification dot on bolt head denotes offset of bolt. When dot is in up position (Fig. 12) left end of bedbar is raised. As bolt is turned clockwise and dot is lowered, so is left end of bedbar. Identification dot must be positioned within rear (180°) position when adjusting.

5. Rotate left hand (eccentric) pivot bolt to raise or lower bedbar as required.

6. Check adjustments by repeating steps 2 and 3.

7. After getting light contact on paper at each end of bedknife, hold left-hand pivot bolt in position and tighten jam nut. Make sure pivot bolt did not get out of adjustment when turning jam nut. Adjust again if necessary.

NOTE: If the reel has worn so you cannot get the bedknife parallel to the reel by turning the eccentric bolt, the reel will require grinding to remove taper. The reel normally wears faster on the lead-in side, which results in the described taper.

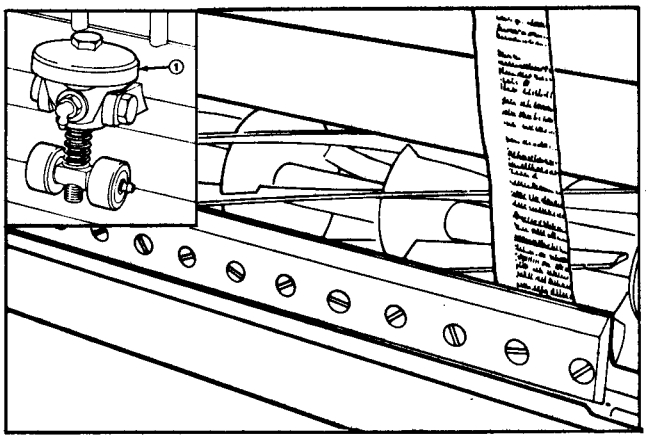


Figure 11

1. Bedknife adjusting knob

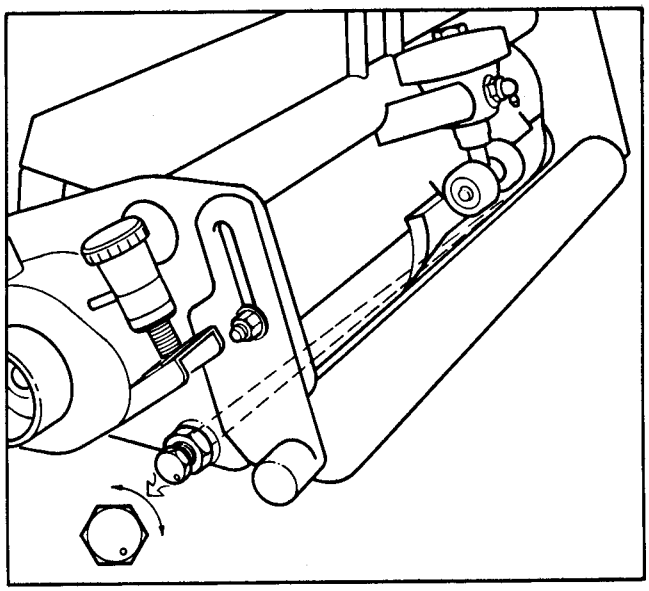


Figure 12

Leveling Rear Roller to Reel

1. Put cutting unit on a flat, level surface.

2. Assemble rear height of cut brackets to desired position, by loosening top capscrew and nut and removing bottom nut on right and left hand sides of cutting unit (Fig. 13).

3. Slide bolts thru each bracket until brackets can be realigned with appropriate mounting hole. See table for proper position on brackets.

NOTE: The different rear roller bracket positioning holes (B thru E) are designed to optimize bedknife location for different heights of cut.

Rear Roller Bracket Hole Position – 8 Blade Cutting Units
Height of cut 3/16 (.187) in. and below use the **B** position Height of cut 5/32 (.156) in. and above Use the **C** position Height of cut between 5/32 (.156) and 3/16 (.187) in., try **C** first; if not satisfactory, use **B** NOTE: For Height of Cut 5/32 (.156) in. and lower use 3/32 in. (tournament) bed knife. Tournament bed knife should not be necessary with the rear roller in the C position.
Rear Roller Bracket Hole Position – 11 Blade Cutting Units
Height of cut 3/16 (.187) in. and below use the **B** position Height of cut 5/32 (.156) in. and above Use the **C** position Height of cut between 5/32 (.156) and 3/16 (.187) in., try **B** first; if not satisfactory, use **C** NOTE: For Height of Cut 3/16 (.187) in. and lower use 3/32 in. (tournament) bed knife. Tournament bed knife should not be necessary with the rear roller in the C position.

NOTE: The "B" hole position normally is the best rear roller location for most low (3/32" - 1/8") cutting conditions.

It may be necessary to change from the above suggested ranges in certain turf conditions.

4. After putting bracket into correct height-of-cut hole position make sure right hand rear roller bracket capscrews are tightened securely (Fig. 14).

5. Left hand rear roller bracket capscrews are to be tightened only enough to remove excessive looseness in assembly, but allow bracket to slide freely on side plate.

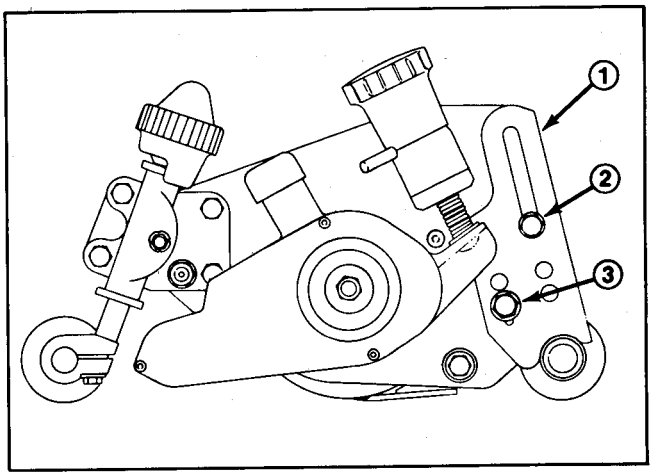


Figure 13

1. Rear height of cut bracket 3. Bottom nut
2. Top capscrew and nut

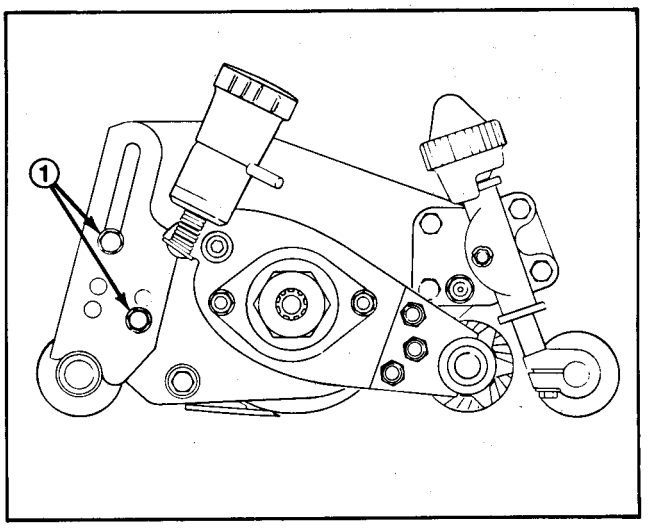


Figure 14

1. Right rear roller bracket capscrews

6. Position a 1/4 inch or thicker plate under the reel blades and against the front face of the bed-knife (Fig. 15).

NOTE: Make sure plate covers full length of reel blades, and (3) blades contact plate (8 blade reel).

7. While holding reel securely on plate, level roller by rotating lower left roller pivot bolt. The pivot bolt has an offset thread which when rotated, acts as a cam to raise or lower the roller. On the bolt head there is an identification dot (Fig. 16) which denotes the offset of the bolt. Dot indicates in which direction left end of roller moves when bolt is turned.

8. To verify if roller is level, try inserting a piece of paper under each end of roller.

9. When roller is level, tighten left capscrew and pivot bolt nuts securely. Hold the eccentric pivot bolt while tightening the nut to keep the proper roller position.

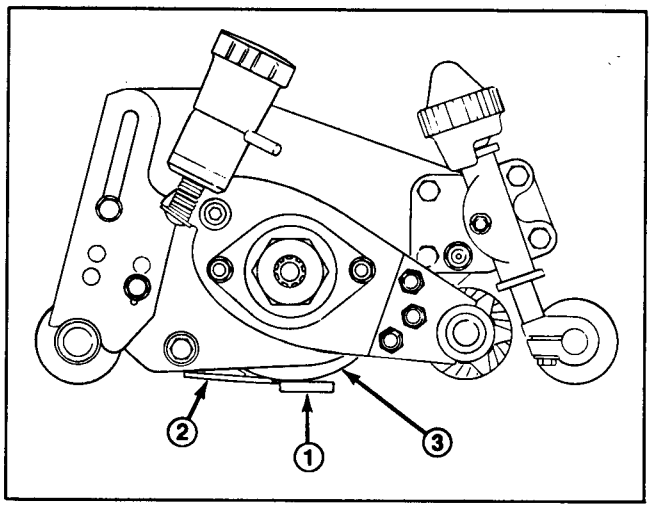


Figure 15

1. 1/4" plate
2. Bedknife
3. Reel

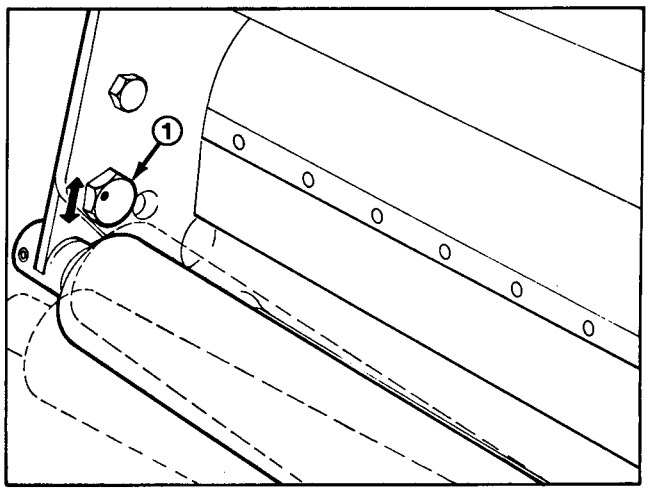


Figure 16

1. Pivot bolt

Height of Cut

Height of cut, as measured on the cutting unit and in the turf is different. The grass prevents the cutting unit from settling all the way to the ground line as the machine moves across the turf. Because of this, the actual (effective) height of cut is higher than the height of cut setting on the cutting unit (bench set height of cut) (Fig. 17).

Machine conditions, such as cutting unit weight, roller type, bedknife thickness, speed of travel and clip frequency, influence effective height of cut. Turf conditions, such as grass type, grass density, and amount of thatch also influence effective height of cut.

Changing the machine (such as adding a wiehle roller, or changing to a heavier grooming reel cutting unit) will increase penetration into the turf and lower the effective height of cut.

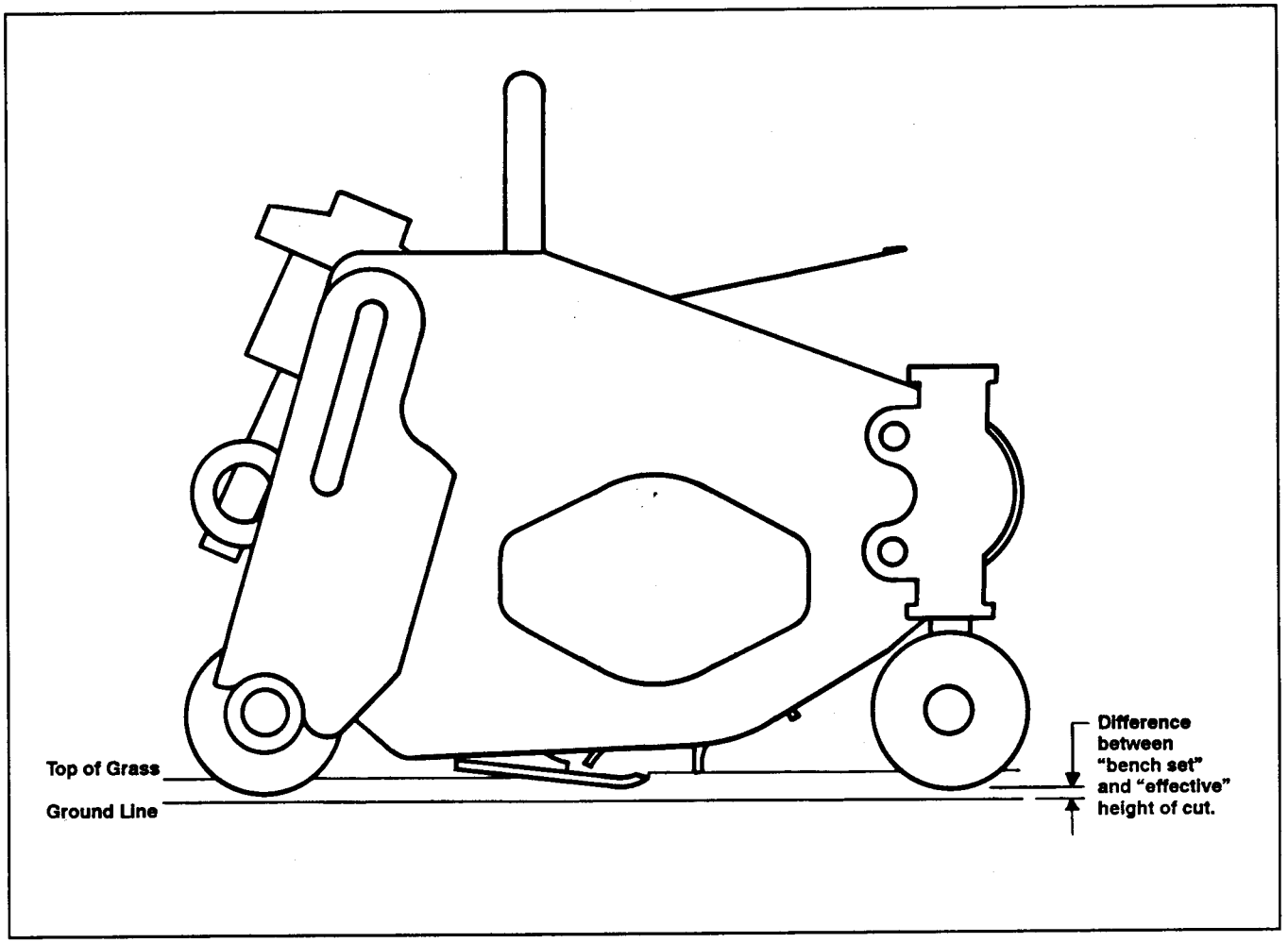


Figure 17

Height of Cut Adjustment

IMPORTANT: Lower heights of cut are limited by thickness of bedknife. Select proper bedknife for desired height of cut. If bedknife is too thick for height of cut, poor quality of cut will result and excessive pressure from turf on bottom of bedknife can cause "rifling" of bedknife and reel.

NOTE: Because of weight difference, "bench set height of cut" should be approximately 0.020 to 0.040 in. higher on grooming reel cutting units to get the same "effective height of cut" as cutting units without groomers.

1. Make sure that rear roller brackets are in correct hole positions for desired height of cut and that rear roller is level. Also, check that bedknife to reel contact is correct.

2. Turn cutting unit over and loosen locknuts securing front roller adjusting screws to height of cut brackets (Fig. 18).

3. On gauge bar (Part No. 1-8789), set head of screw to desired height of cut. This measurement is from bar face to underside of screw head.

4. Place bar across front and rear rollers and adjust height of cut knob until underside of screw head engages bedknife cutting edge (Fig. 18). Check and adjust on each end of bedknife, then tighten height of cut adjustment locknuts on each end.

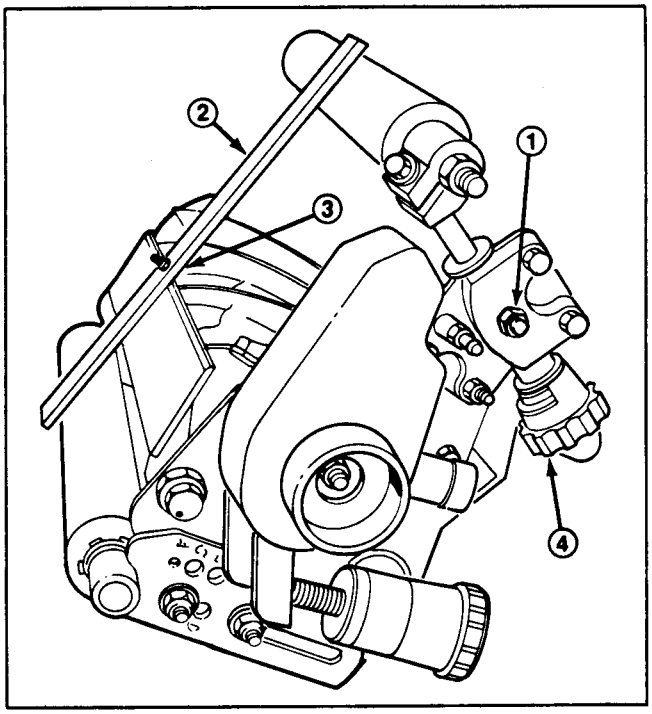


Figure 18

1. Height of cut knob locknut
2. Gauge bar (1-8789)
3. Screw head over bedknife
4. Adjustment knob

Changing To A Different Type of Cutting Unit or Adding Cutting Unit Accessories

When changing to a different type of cutting unit or adding cutting unit accessories, it is recommended that you change only one cutting unit, and keep the other two existing cutting units on the machine.

1. Set the new cutting unit to a height of cut approximately 1/16 (0.06) in. higher than the old cutting unit.

2. Do a mowing test and compare results between the new cutting unit and old cutting units.

3. Adjust the new cutting unit to match the cut of the old cutting units.

4. The other two cutting units can now be replaced. Adjust these two new cutting units so they are the same as the other new cutting unit that was tested.

Groomer Reel Depth Adjustment

1. Adjust cutting unit height of cut before doing groomer reel depth adjustment.

2. Hold clutch snubber down and rotate the clutch clockwise to disengage the clutch (Fig. 6). Rotate both quick up levers to lower the grooming reel into grooming position.

3. Hold a straight bar securely against the front and rear rollers on one side of the cutting unit (Fig. 19). While holding the bar in place, lift and turn the micro adjustment knob until the groomer blade just touches the bar (rotating the groomer reel by hand will assist in determining if blades are lightly touching the bar).

4. Repeat step 3 on the opposite side of the cutting unit, then check the adjustment on the other side again. Adjust again if necessary.

5. Each notch on the micro adjustment knob equals approximately 0.007 in. of groomer height/depth. Divide the desired height/depth setting of the groomer reel by 0.007 to determine how many notches to turn the micro adjustment knob. Make sure each knob is turned the same number of notches. Turn counterclockwise to raise groomer reel and clockwise to lower.

Example: Desired groomer setting of 1/32 (0.03125) in. higher than bottom of rollers:

0.03125 ÷ 0.007 = 4.46 (4 or 5 notches)

6. Rotate both quick up levers to raise the grooming reel into transport position. Make sure the clutch is disengaged.

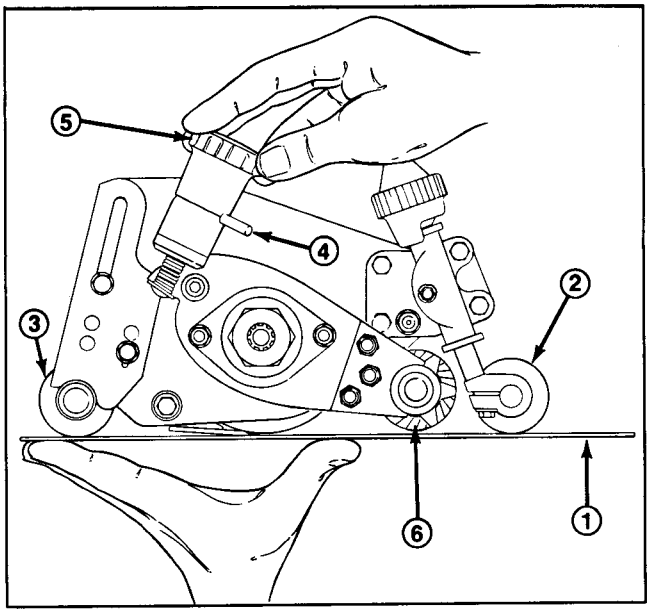


Figure 19

1. Bar
2. Front roller
3. Rear roller
4. Quick up lever (2)
5. Micro adjustment knob (2)
6. Groomer reel touching bar

Shield Height Adjustment

Adjust shield to get proper grass clipping discharge into basket:

1. Set cutting unit in normal cutting position and measure distance from top of front crossbar to shield at each end of cutting unit (Fig. 20).

2. Height of shield from crossbar for normal cutting conditions should be 4-3/4 inches. Loosen capscrews and nuts securing shield to each side plate, adjust shield to correct height and tighten fasteners (Fig. 20).

3. Repeat adjustment on remaining cutting units and adjust top bar. (See Adjusting Top Bar in this section of the book.)

NOTE: Shield can be lowered in dry grass conditions (clippings fall over top of baskets) or raised to allow for heavy wet grass conditions (clippings build up on rear edge of baskets).

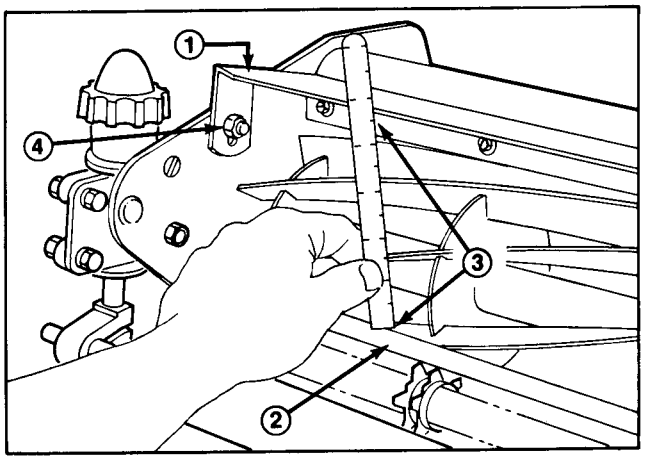


Figure 20

1. Shield
2. Front crossbar
3. 4-3/4 inches
4. Shield fasteners

Top (Cut Off) Bar Adjustment

Adjust top bar to make sure clippings are cleanly discharged from reel area:

1. Loosen screws securing top bar (Fig. 21). Insert 0.060 inch feeler gauge between top of reel and bar and tighten screws. Make sure bar and reel are equal distance apart across complete reel.

2. Repeat settings on remaining cutting units.

NOTE: Bar is adjustable to compensate for changes in turf conditions. Bar should be adjusted closer to reel when turf is extremely wet. By contrast, adjust bar further away from reel when turf conditions are dry. Bar should be parallel to reel to get optimum performance and should be adjusted whenever shield height is adjusted or whenever reel is sharpened on a reel grinder.

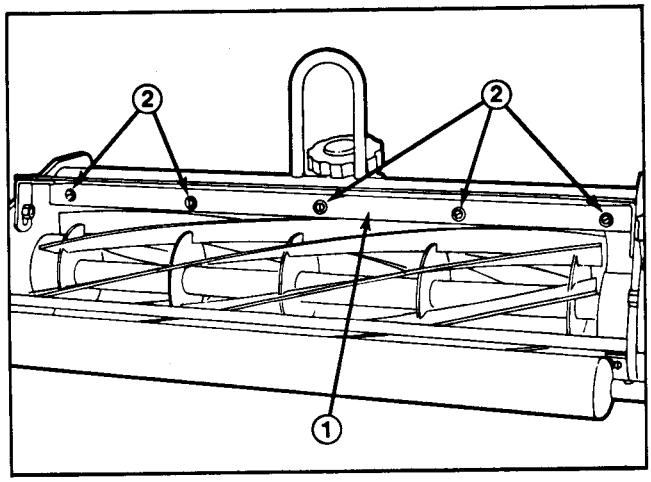


Figure 21

1. Top bar **2. Bar mounting screws**

Groomer Reel Drive Belt Adjustment

1. Loosen two (2) set screws and remove clutch knob (Fig. 6). Remove groomer reel housing cover from left side of cutting unit (Fig. 8).

2. Apply 5-10 lb. of force on the belt midway between the pulleys to check tension on the drive belt. There should be 1/4 inch belt deflection. If deflection is not 1/4 inch, loosen the idler pulley pivot screw (Fig. 22). Pivot the idler to get proper tension and tighten the allen head screw to a torque of 7-10 ft-lb.

3. Install groomer reel housing cover. Install clutch knob and tighten two (2) set screws against flats on release disk.

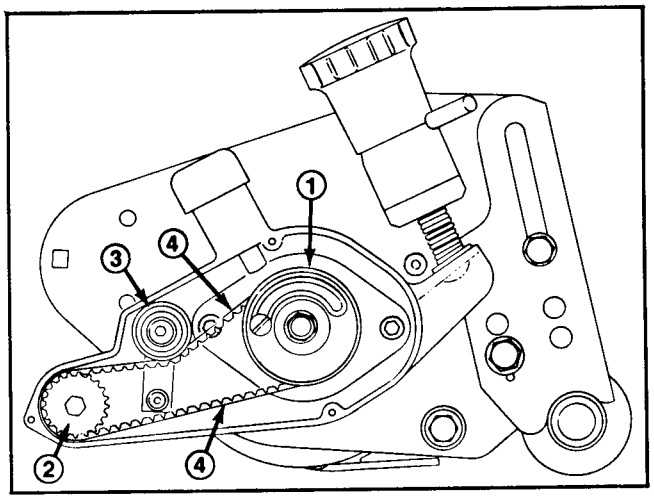


Figure 22

1. Drive pulley and clutch assembly
2. Driven pulley
3. Drive belt (backside) idler pulley
4. Drive belt

Pull Frame Adjustment

1. Put the basket on the pull frame.

2. Level baskets to cutting unit by loosening nut at one end of pull frame roller. Loosen bolt and move roller shaft in slot as necessary. Tighten bolt.

3. Loosen the jam nuts on the pull arms and adjust the ball sockets until there is 1/4 in. to 1/2 in. (6 to 13 mm) clearance between the lip of the basket and the reel blades (Fig. 23a). This prevents grass clippings from dropping on the ground.

4. Make sure the basket lips are the same distance from the reel blades at both ends of the reel. If the basket is too close to the reel, it is possible for the reel to contact the basket at the instant the cutting unit is raised off the ground.

5. Make sure each of the three (3) cutting units track straight with the traction unit:

   A. On a smooth, level surface, draw a straight line on the floor (Fig. 23b). Push traction unit forward (removing slack from pull arms) so center of each front wheel is on top of the line. Use a plumb bob or square to make sure each wheel is centered on the line.

   B. Measure from each end of cutting unit front roller to chalk line. Distance from each end of roller to line must be equal within 3/16 (0.187) in.

   C. Loosen jam nuts on pull arms and adjust ball sockets so distance from each end of roller to line is within 3/16 (0.187) in.

NOTE: If a cutting unit cannot be adjusted to track correctly with the traction unit, the pull frame, or lift arm is damaged and/or the lift arm and pull frame bushings are worn and must be replaced.

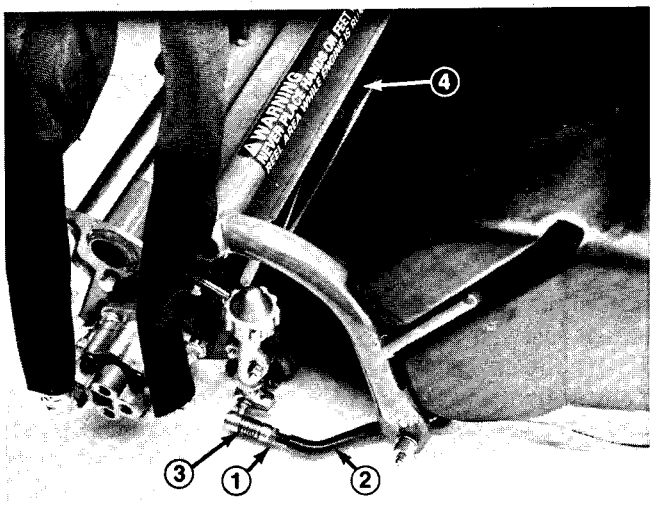


Figure 23a

1. Jam nut
2. Pull arm
3. Ball joint - adjust for clearance
4. 1/4 - 1/2 in. (6 - 13 mm) clearance

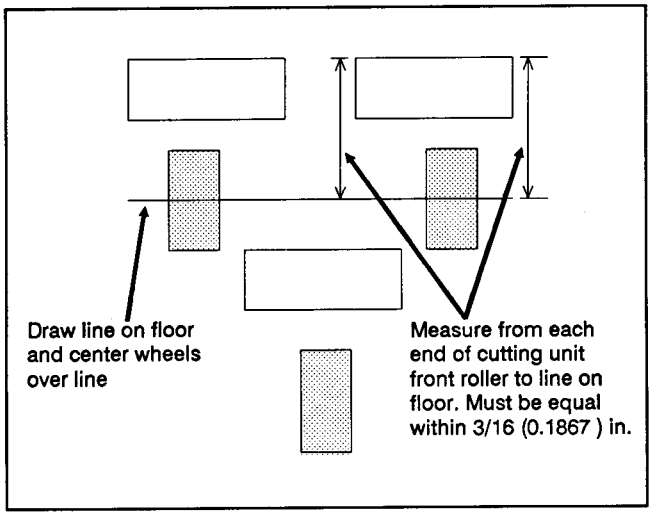


Figure 23b

1. Jam nut
2. Pull arm
3. Ball joint - adjust for clearance
4. 1/4 - 1/2 in. clearance

Cutting Unit Removal and Installation

Remove cutting unit from traction unit before doing adjustments or repairs.

1. Remove basket from pull frame.

2. Loosen reel motor mounting nuts (Fig. 24). Rotate the motor clockwise so motor flanges clear studs and pull motor off of cutting unit.

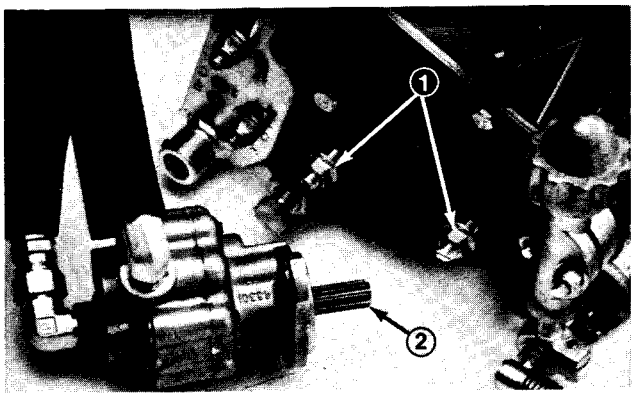


Figure 24

1. Motor mount nuts **2. Motor shaft**

3. Slide the sleeve back on the ball joint and disconnect the pull arm from each side of the cutting unit (Fig. 25).

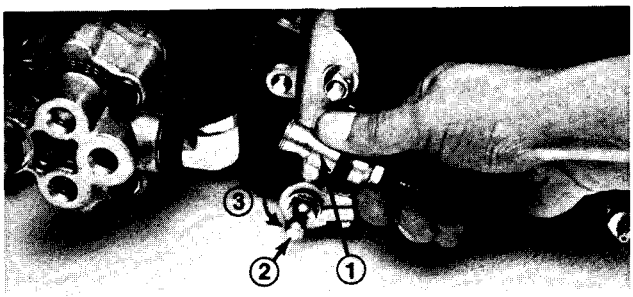


Figure 25

1. Slide back to mount
2. Ball stud
3. Swing up to remove, down to install

4. Slide cutting unit out from under pull frame, disengaging the lift arm from the lift bail (Fig. 26).

5. Reverse steps 1 - 4 to install the cutting unit.

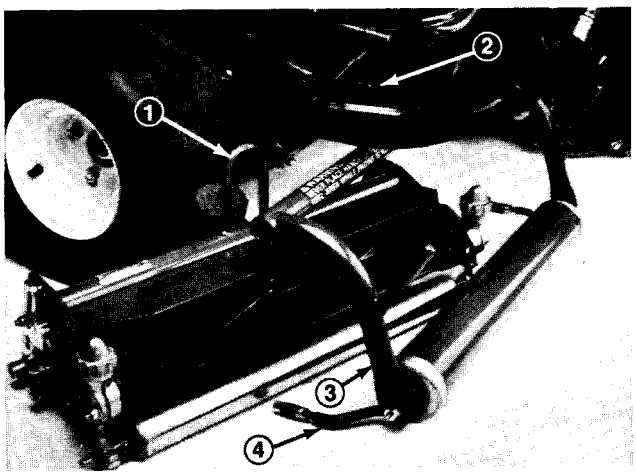


Figure 26

1. Lift bail **3. Pull frame**
2. Lift arm **4. Pull arm**

Reel Lapping

Check reel bearing adjustment and correct if necessary before backlapping. Make sure bedknife is parallel to reel. On groomer equipped cutting units, backlap by using a length of 3/8 in. square stock inserted into the center hole in the reel shaft on the reel drive motor end of the cutting unit. Attach a socket, extension and backlapping machine. Backlap according to procedures in the Toro publication "Sharpening Reel & Rotary Mowers" Form No. 80-300-PT.

NOTE: For a better cutting edge, run a file across front face of bedknife when lapping operation is completed. This will remove any burrs or rough edges that may have built up on the cutting edge.

CAUTION

Be careful when lapping the reel because contact with the reel or other moving parts can result in personal injury.

Bedbar Removal and Installation

1. Loosen pivot screws securing bedknife pivot assembly to reel frame supports (Fig. 27).

2. Rotate adjustment knob and pivot assembly clockwise (left hand thread) until it is unthreaded from bedbar pivot (Fig. 27).

3. Loosen jam nuts retaining right and left bedbar pivot bolts. Remove pivot bolts (Fig. 27).

IMPORTANT: Note position of plastic washer and steel washer on right end of bedbar, and plastic washer on left end of bedbar for reinstallation.

4. Slide bedbar down and out from under cutting unit. Do not misplace washers.

5. Replace and/or grind bedknife to renew cutting edges.

NOTE: For proper grinding of bedknife, follow procedures in the Toro publication, "Sharpening Reel and Rotary Mowers", Form No. 80-300-PT.

6. Adjust the reel bearings. (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter.)

7. Grind the reel to remove any taper and renew cutting edges. (See Preparing Cutting Unit for Reel Grinding in this section of the book.)

8. Check size of hole in bedbar end bushings every time bedbar is removed. Insert flange bushing into rubber bushing (Fig. 28). Insert clean shoulder bolt into flange bushing/rubber bushing assembly. If bolt slides easily into bushing, replace all four bedbar bushings. (See Bedbar Bushing Replacement in this section of the book.)

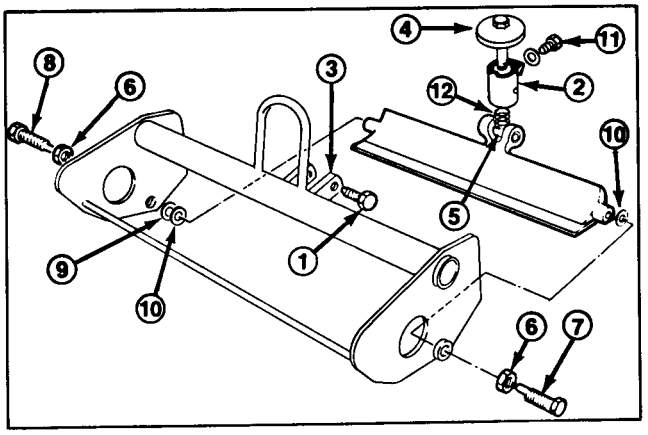


Figure 27

1. Pivot screw
2. Bedknife pivot ass'y
3. Frame supports
4. Adjustment knob
5. Bedbar pivot
6. Jam nuts
7. Left bedbar pivot bolt
8. Right bedbar pivot bolt
9. Steel washer
10. Plastic washer
11. Spring arm retaining capscrew
12. Compression spring

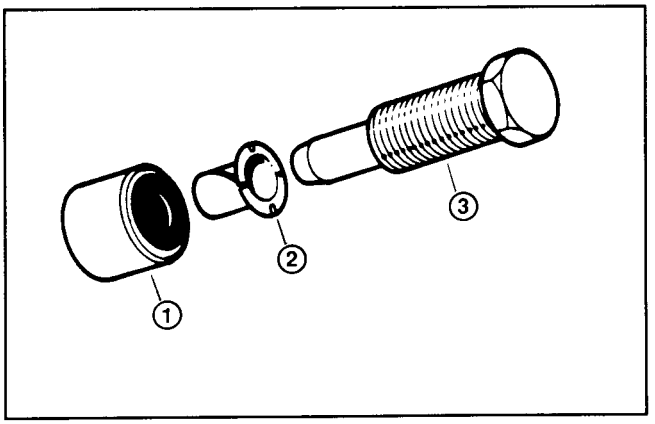


Figure 28

1. Rubber bushing
2. Flange bushing
3. Shoulder (pivot) bolt

9. With frame on level surface and pivot set screws installed, measure from flat surface up to end of each setscrew (Fig. 29). If not within 1/16 in. of each other, carefully bend frame supports to line up screws. Remove pivot set screws. Measure distance between frame pivot supports (Fig. 29). If dimension is not between 1-9/16 in. and 1-5/8 in., carefully bend supports until correct.

10. To install bedbar, slide it into position between side plates, making sure each end of bedbar is under shield (Fig. 30).

IMPORTANT: Always use McLUBE (Toro Part No. 505-35) on bedbar pivot and pivot bolts.

11. Install jam nut on eccentric pivot bolt. Put plastic washer between left side of bedbar and side plate. Thread pivot bolt into side frame until distance from top of pivot bolt to side plate is 1-5/16 in. with identification dot toward the rear (Fig. 31). Do not tighten jam nut.

12. Install jam nut on straight pivot bolt. Put plastic washer and steel washer between right side of bedbar and side plate with plastic washer closest to bedbar. Thread pivot bolt into side plate. Adjust right-hand pivot bolt until left end of bedbar firmly seats against the plastic washer and side plate, clamping the plastic washer snugly. This removes end-play from bedbar. Bedbar must pivot without binding. Hold right-hand pivot bolt to keep it from moving and tighten jam nut.

IMPORTANT: Apply NEVER-SEEZ or equivalent to the threads of the handle assembly.

13. Thread adjustment knob and pivot assembly into flat side of bedbar pivot (left-hand thread). Make sure there is an equal gap between each side of pivot assembly housing and frame supports (Fig. 32). Adjust (before installing pivot screws) by sliding bedbar pivot sideways.

IMPORTANT: On hand-adjustable knobs, check to make sure die spring is compressed to 13/16 in. by tightening locknut (left-hand thread).

14. If equipped with hex head type pivot screws, tighten pivot screws to 60 ft-lb. If equipped with hex socket head set screws and jam nuts, tighten set screws finger tight, then tighten an additional 1/2 turn (total - not each). Tighten jam nuts.

15. Secure spring arm to pivot assembly. If spring arm is adjustable, adjust upward until a solid clicking sound is achieved when adjusting knob is turned.

16. Level bedknife to reel. Level rear roller to reel. Set height of cut. If necessary, backlap to get desired fit between reel and bedknife.

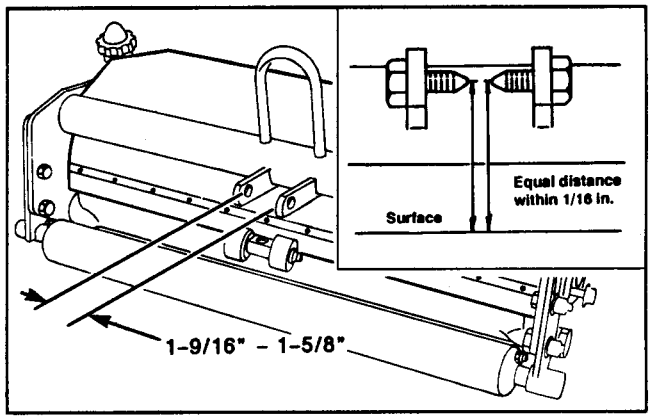


Figure 29

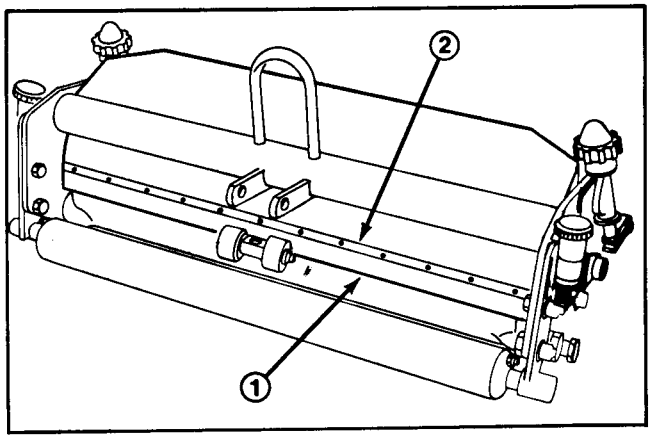


Figure 30

1. Bedbar **2. Shield**

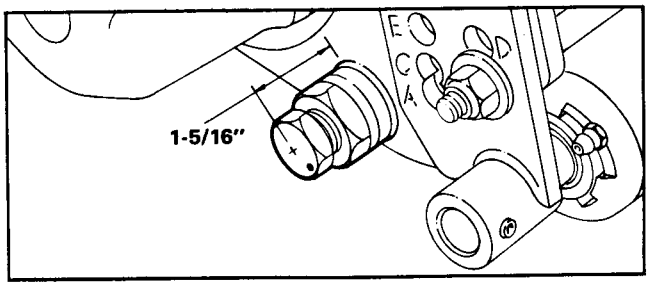


Figure 31

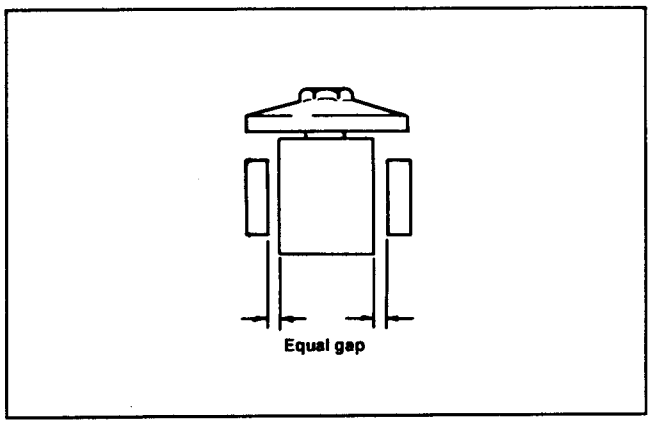


Figure 32

Bedbar Bushing Replacement

NOTE: Only after making sure that all normal cutting unit adjustments are correct, should the bushings be suspected as causing quality of cut problems.

The bedbar end bushings and pivot bushings (Fig. 33) contain rubber and are exposed to severe conditions. It is recommended to replace these bushings and the plastic flange bushings every two years.

1. Do steps 1 - 4 under Bedbar Removal and Installation in this section of the book.

2. Remove bedbar end bushings with a punch and hammer (Fig. 34). Alternate from one side to other on bushing (there are two slots in bedbar bushing boss).

IMPORTANT: Apply "Never-Seez" or equivalent to outside surface of bedbar end bushings and pivot bushings before installing in bedbar.

3. Press end bushings into bedbar far enough so plastic sleeve collar is below bedbar end face (Fig. 35).

NOTE: Bedbar end bushings have less rubber and more steel which is visible than bedbar pivot bushings. Do not use bedbar end bushings in the pivot area as they are too rigid.

4. Use an arbor press to remove bedbar pivot bushings (Fig. 36). DO NOT hammer on pivot boss of bedbar without support. You will break the casting.

5. Press center pivot bushings into place (Fig. 36). DO NOT hammer on pivot boss of bedbar without support. You will break the casting.

6. Do steps 5 - 16 under Bedbar Removal and Installation in this section of the book.

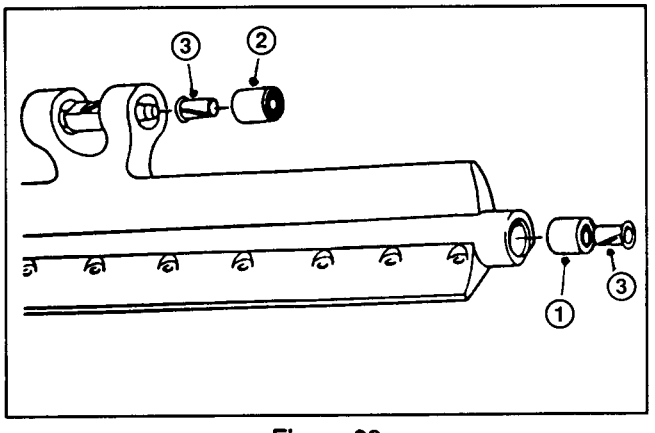


Figure 33

1. Bedbar end bushing (2)
2. Bedbar pivot bushing (2)
3. Flange bushing (4)

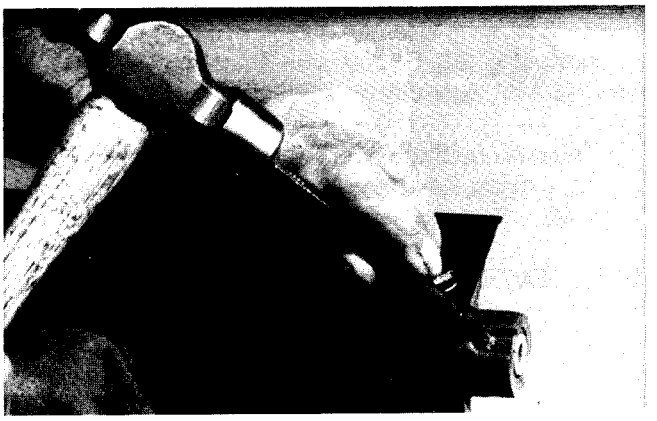


Figure 34

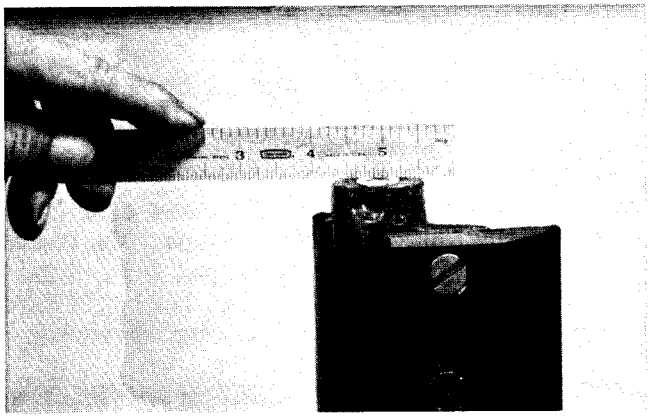


Figure 35

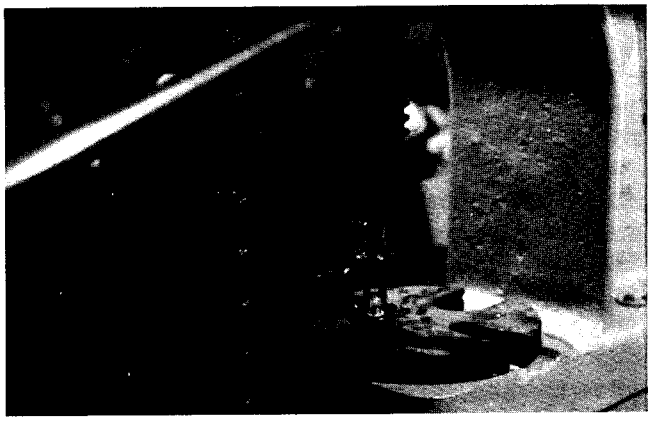


Figure 36

Bedknife Replacement

1. Do steps 1 - 4 under Bedbar Removal and Installation in this section of the book.

2. Remove bedknife screws and remove bedknife.

3. Remove all rust, scale and corrosion from bedbar surface before installing new bedknife.

4. Install new bedknife with the proper bedknife screws (57-4910). Bedknife screws must bottom out on bedknife, not bedbar. Tighten screws to a torque of 200 in-lb, working from the center toward each end of the bedbar (Fig. 37).

5. Grind new bedknife to match it to bedbar.

NOTE: For proper grinding of bedknife, follow procedures in the Toro publication "Sharpening Reel and Rotary Mowers", Form No. 80-300-PT..

6. Do steps 6 - 16 under Bedbar Removal and Installation in this section of the book.

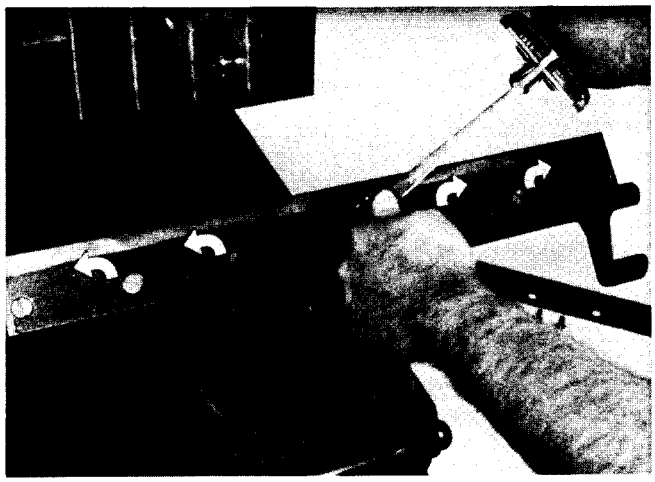


Figure 37

Preparing Cutting Unit for Reel Grinding

IMPORTANT: Adjust reel bearings before grinding reel. (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter

1. Do steps 1 - 6 under Bedbar Removal and Installation in this section of the book.

NOTE: Some reel grinders require rear roller assembly be mounted to cutting unit for proper support in reel grinder. Rear roller must be parallel to reel shaft to remove taper when grinding.

2. Raise or remove front roller assembly.

   A. Loosen locknuts securing height of cut adjusting rods at both ends of cutting unit and roller shaft clamp bolts (Fig. 38).

   B. Turn height of cut adjustment knobs to raise rollerr out of the way or remove roller if necessary.

For proper grinding of reel, follow procedures in the Toro publication "Sharpening Reel and Rotary Mowers Form No. 80-300-PT.

3. Do steps 8 - 16 under Bedbar Removal and Installation in this section of the book. After grinding, assemble cutting unit, check bearing adjustment and adjust top shield and bar. Back lap if necessary to get desired fit between reel and bedknife.

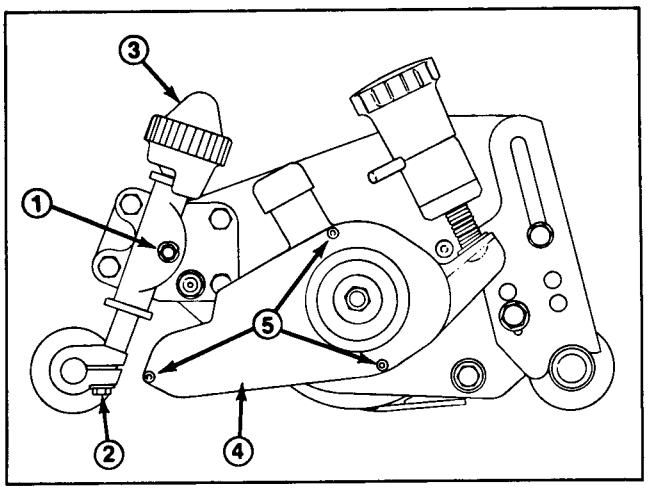


Figure 38

1. Height of cut locknut
2. Roller shaft clamp bolt
3. Height of cut knob
4. Grooming reel cover
5. Cover screws and washers

Reel Removal and Bearing Replacement

1. Do steps 1 - 4 under Bedbar Removal and Installation in this section of the book.

2. Loosen two (2) set screws and remove clutch knob. Remove groomer reel housing cover from left side of cutting unit (Fig. 39).

3. Remove grooming reel adjustment knob assembly from groomer housing (Fig. 40).

CAUTION

Adjustment knob assembly is spring loaded.

4. Loosen idler pulley (Fig. 40). Remove nut and washer from clutch adapter shaft. Pull clutch assembly off adapter shaft and slide belt off driven pulley. Remove clutch adapter from reel shaft (Fig. 49).

5. Remove driven pulley from groomer shaft (left-hand thread) (Fig. 40).

6. Remove two (2) locknuts and flat head socket screws to remove bearing adapter and left side groomer housing (Fig. 41).

7. Remove locknut from the right end of groomer reel shaft to remove groomer reel. Remove grooming reel adjustment knob assembly from right side groomer plate assembly (Fig. 42).

8. Remove two (2) flange locknuts (reel motor mounting nuts). Remove two (2) inside locknuts. Use a stud removal tool or double nuts to remove special studs. Remove groomer bearing adapter and right side groomer plate (Fig. 42).

9. Remove bearing adjustment locknut from left end of reel shaft. Remove spline nut from right end of reel shaft.

IMPORTANT: Remove grease fittings from bearing housing at each end of cutting unit. Note that the straight fitting is on the right end, and 90° fitting at the left end (when viewed in the direction of travel).

10. Use a soft face hammer to rotate each bearing housing slightly. Install bolts from outside of housings and turn bolts alternately against side plate to remove bearing housings (Fig. 43). Bearing housings will slip out of side plates. Reel can be removed as soon as bearing housings are disassembled from side plates.

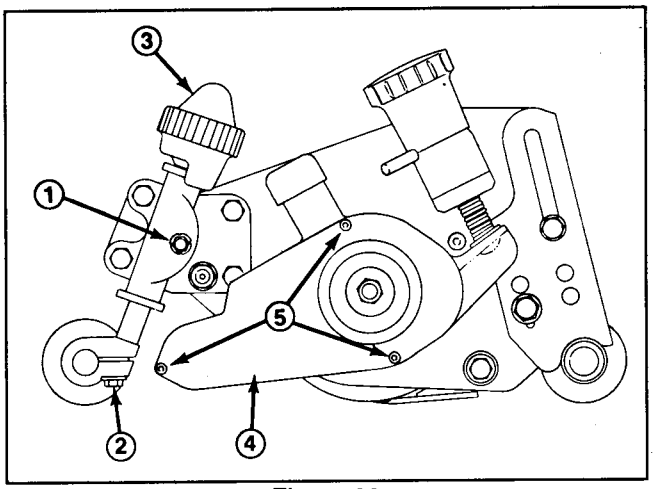


Figure 39

1. Height of cut locknut
2. Roller shaft clamp bolt
3. Height of cut knob
4. Grooming reel cover
5. Cover screws & washers

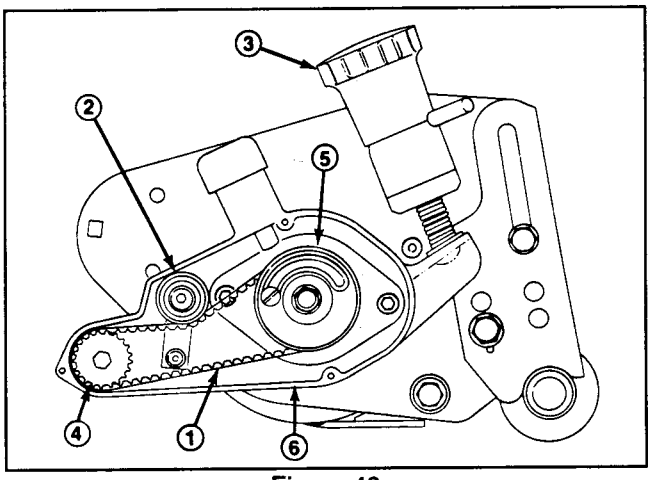


Figure 40

1. Drive belt
2. Drive belt idler pulley
3. Grooming reel adjustment knob assembly
4. Groomer driven pulley
5. Clutch assembly
6. Groomer reel housing

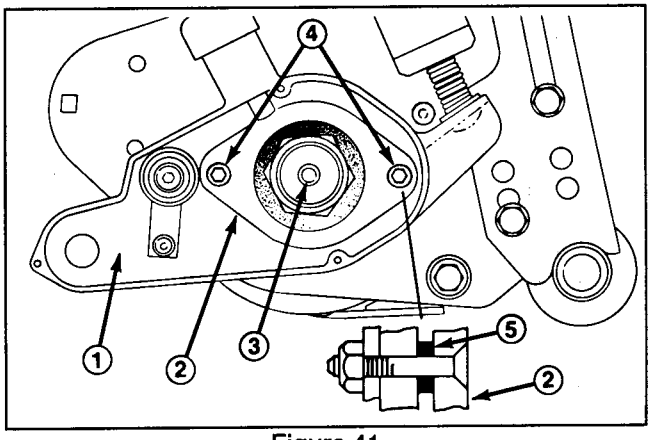


Figure 41

1. Left side groomer housing
2. Bearing adapter
3. Reel bearing adjustment nut
4. Flat head screws
5. Spacer

11. If necessary, install new bearings and seals:

A. Remove bearing cup, bearing cone and inner seal.

B. Bearing housing must be completely free of paint and foreign material before installing bearing cup. If necessary remove any "flash" from bearing housing that may interfere with accurate seating of bearing. Install inner seal. Install bearing cup.

C. Install bearing housing to frame. Pack bearing cone with grease and install over reel shaft into bearing cup.

12. After installing reel, tighten spline nut to 40 - 60 ft-lb, then adjust bearings (See Reel Bearing Service and Adjustment in the Adjustments section of this chapter.)

Use Loctite 271 on spline nut threads.

13. Install right side groomer plate assembly and bearing adapter. Use a stud installation tool or double nuts to tighten two (2) special studs to 17 - 21 ft-lb. Make sure a spacer is installed over each stud between groomer bearing adapter and reel bearing housing. Tighten two (2) inside locknuts to 23 - 27 ft-lb. Install two (2) flange locknuts (reel motor mounting nuts). (Fig. 42).

14. Install grooming reel adjustment knob assembly to right side groomer plate assembly (Fig. 42). Install groomer reel shaft to right side groomer plate assembly and install locknut on right end of groomer shaft.

15. Install left side groomer housing and bearing adapter (Fig. 41). Install two (2) flat head socket screws and tighten to 17 - 21 ft-lb. Make sure a spacer is installed over each flat head socket screw between groomer bearing adapter and reel bearing housing. Install two (2) locknuts and tighten to 23 - 27 ft-lb.

16. Install groomer reel driven pulley to groomer reel shaft (left-hand thread) and tighten to 29 - 35 ft-lb (Fig. 40).

17. Install clutch adapter on reel shaft and tighten to 170 - 210 in-lb (Fig. 49). Hold belt on drive pulley and slide clutch assembly on clutch adapter while sliding belt onto driven pulley (Fig. 40). Install washer and nut (removed in step 4) on clutch adapter shaft. Use a block of wood to keep reel from rotating and tighten nut to a torque of 7 - 10 ft-lb.

18. Install grooming reel adjustment knob assembly to left side groomer housing (Fig. 40).

19. Adjust belt tension. (See Groomer Reel Drive Belt Adjustment in the Adjustments section of this book.) Install groomer reel housing cover (Fig. 39). Install clutch knob and tighten two (2) set screws against flats of clutch release disk.

20. Do steps 5 - 16 under Bedbar Removal and Installation in this section of the book.

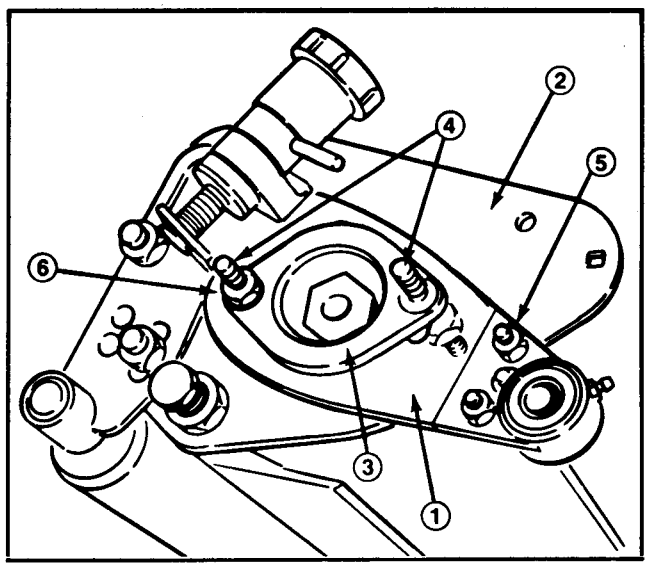


Figure 42

1. Right side groomer plate ass'y
2. Right reel frame plate
3. Groomer bearing adapter
4. Special stud (2)
5. Inside locknut (2)
6. Flange locknut (2)

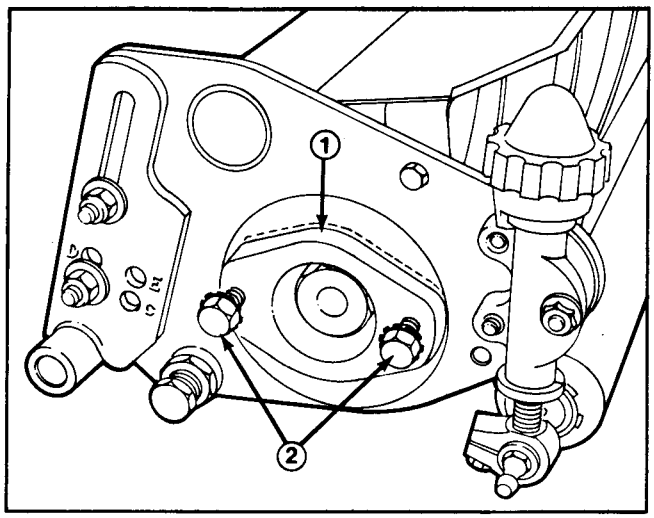


Figure 43

1. Bearing housing
2. Bolt

Groomer Reel Blade Service

Inspect grooming reel blades frequently for damage and wear. Straighten bent blades with a pliers. Either replace worn blades or reverse the grooming reel shaft to put the sharpest blade edge forward (Fig. 44). (See Groomer Reel Removal and Installation in this section of the book.). During blade inspection procedures, check to make sure the right and left blade shaft end nuts are tight.

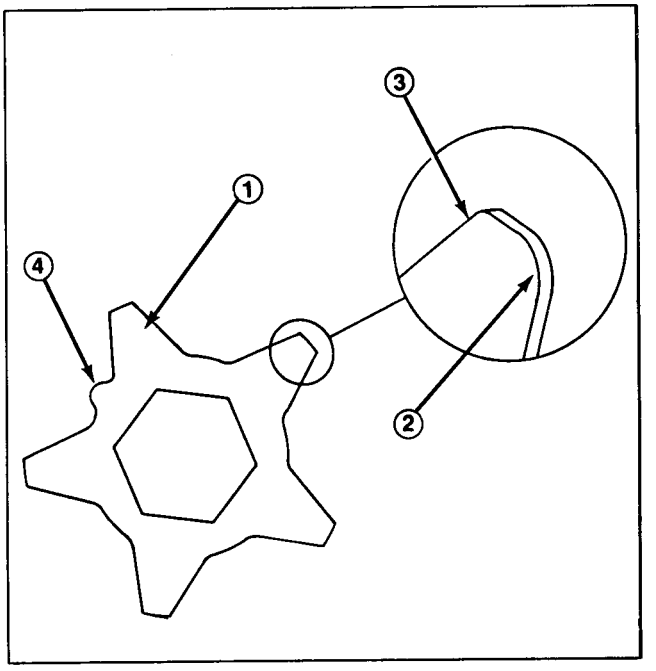


Figure 44

1. Grooming blade
2. Dull rounded edge
3. Sharp edge
4. Location mark

Groomer Reel Drive Belt Replacement

1. Loosen two (2) set screws and remove clutch knob (Fig. 6). Remove groomer reel housing cover from left side of cutting unit (Fig. 39).

2. Loosen the backside idler pulley pivot screw (Fig. 45). Pivot idler to loosen and remove belt.

3. Install the belt. The belt should have a deflection of 1/4 in. when 5 - 10 lb. of force is applied midway between the pulleys. Pivot the idler to get proper tension and tighten the allen head screw to a torque of 7 - 10 ft-lb.

4. Install groomer reel housing cover. Install clutch knob and tighten two (2) set screws against flats on release disk.

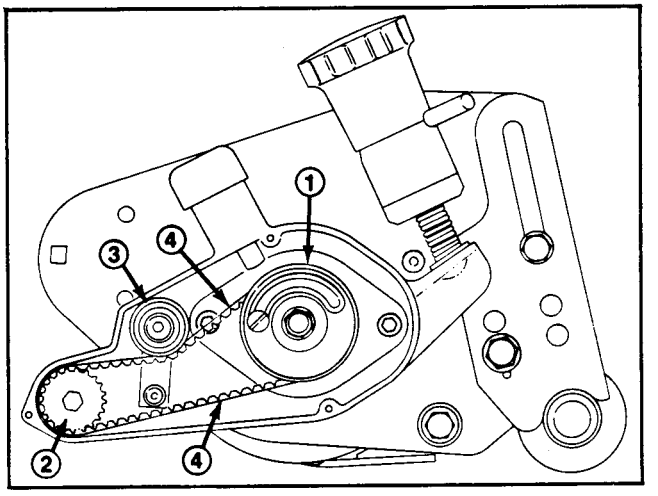


Figure 45

1. Drive pulley and clutch assembly
2. Driven pulley
3. Drive belt (backside) idler pulley
4. Drive belt

Groomer Reel Removal and Bearing Service

1. Loosen two (2) set screws and remove clutch knob (Fig. 6). Remove groomer reel housing cover from left side of cutting unit (Fig. 39).

2. Loosen the backside idler pulley pivot screw (Fig. 45). Pivot idler to loosen and remove belt.

3. Remove groomer driven pulley from groomer reel shaft (left-hand thread) (Fig. 45).

4. Remove locknut from right end of groomer reel shaft (Fig. 46a).

5. Remove three (3) screws and nuts securing bearing housing to right side groomer plate (Fig. 46a). Remove right side bearing bracket from groomer reel shaft. Remove groomer reel shaft from bearing support in left side groomer housing (Fig. 46b).

6. Check condition of groomer shaft bearings and replace if necessary (Fig. 47). Bearings must be installed with seal facing out on each side of bearing housing. For each groomer housing (R.H. and L.H.), install outer bearing and spacer first. Install inner bearing so it is flush with the housing (Fig. 47)

7. To replace groomer reel blades, remove locknut on each end of groomer reel shaft. Remove blades and spacers. Install new blades and previously removed spacers. Install locknut on each end of groomer shaft to secure blades and spacers.

NOTE: Spacers are available for 1/4 in. (76 blades) or 3/4 in. (26 blades) blade spacing.

8. Reverse steps 1 - 5 to install groomer reel. Check drive belt tension before installing cover. (See Groomer Reel Drive Belt Replacement in this section of the book.)

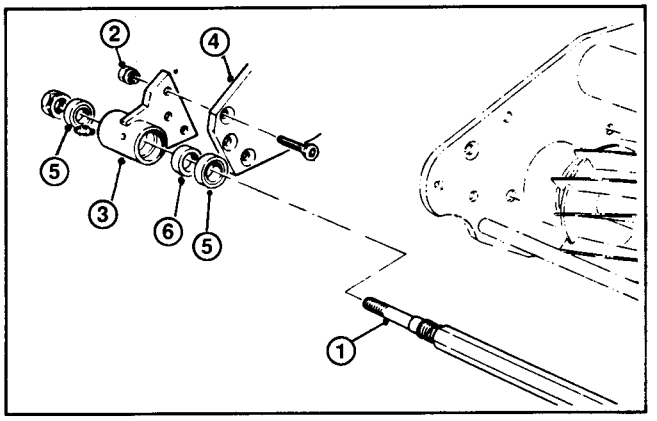


Figure 46a

1. Groomer reel shaft
2. Locknut
3. R.H. groomer housing
4. R.H. groomer plate
5. Bearing
6. Bearing spacer

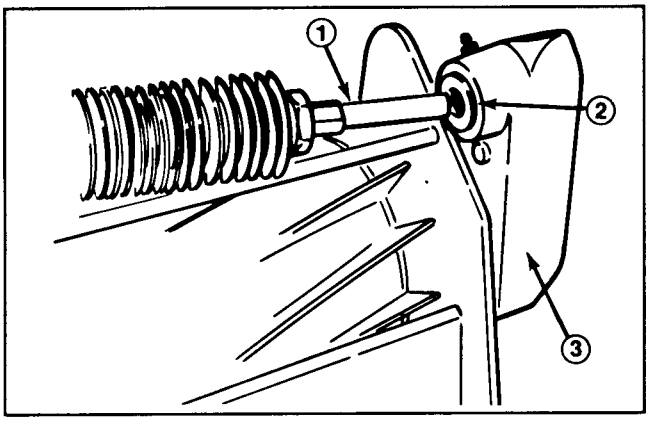


Figure 46b

1. Groomer reel shaft
2. Bearing
3. L.H. groomer housing

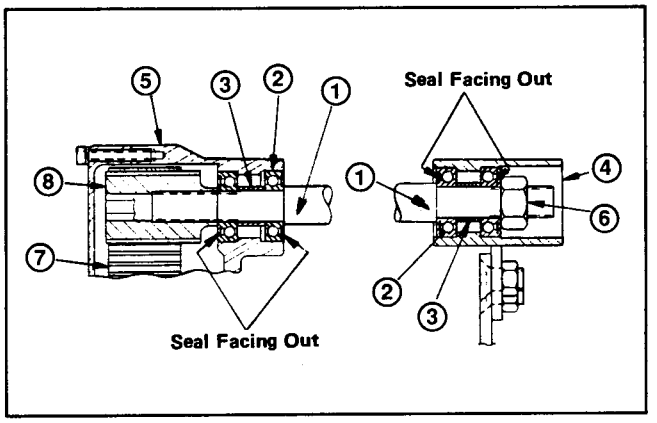


Figure 47

1. Groomer reel shaft
2. Bearing (4)
3. Bearing spacer (2)
4. R.H. groomer housing
5. L.H. groomer housing
6. Locknut
7. Belt
8. Driven gear

Groomer Reel Clutch Service

CAUTION

Do not use your hand to prevent reel from turning while servicing; this can result in personal injury. Use a 1/2 in. thick x 3 in. wide x 8 in. long piece of hardwood inserted into front of cutting unit between reel blades.

Removal and Disassembly

1. Loosen two (2) set screws and remove clutch knob (Fig. 51). Remove groomer reel housing cover from left side of cutting unit (Fig. 39).

2. Loosen idler pulley pivot screw (Fig. 45). Pivot idler to loosen belt.

3. Remove nut and washer from clutch adapter shaft (Fig. 51). Pull clutch assembly off adapter shaft and slide belt off driven pulley.

5. Remove clutch adapter from reel shaft if necessary (Fig. 49).

6. To disassemble clutch, remove special screw and clutch pin (Fig. 51).

IMPORTANT: The special screw and clutch pin were assembled using "Loctite 271". It will be necessary to apply heat to these parts before disassembly.

7. Check condition of roller bearing and needle bearing (Fig. 51). Replace bearings if worn or damaged.

Installation and Assembly (New Clutch Assembly)

1. Loosen two (2) set screws and remove clutch knob from new clutch assembly (Fig. 48). Use a block of wood to keep the reel from rotating and remove nut and washer from clutch adapter shaft (Fig. 48)

2. Pull clutch adapter out of new clutch assembly and install on reel shaft. Tighten clutch adapter to a torque of 170 - 210 in-lb.

3. Hold belt on drive pulley of clutch and slide clutch on clutch adapter while sliding belt on driven pulley.

IMPORTANT: If clutch has come apart since nut and washer were removed in step 1, make sure belleville washers are installed as shown in Figure 50.

4. Install washer and nut (removed in step 1) on clutch adapter shaft and tighten nut to a torque of 7 - 10 ft-lb.

5. Adjust belt tension. (See Groomer Reel Drive Belt Adjustment in the Adjustments section of this book.) Install groomer reel housing cover (Fig. 39). Install clutch knob and tighten two (2) set screws against flats of clutch release disk.

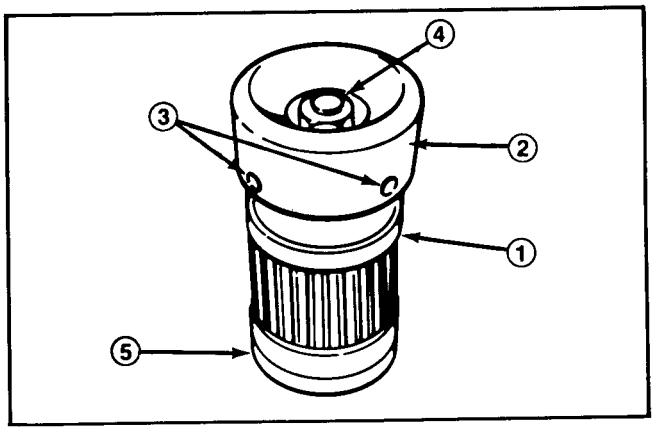


Figure 48

1. **Belt drive clutch assembly**
2. **Clutch engage / disengage knob**
3. **Allen head set screw (2)**
4. **Nut and washer**
5. **Clutch adapter shaft**

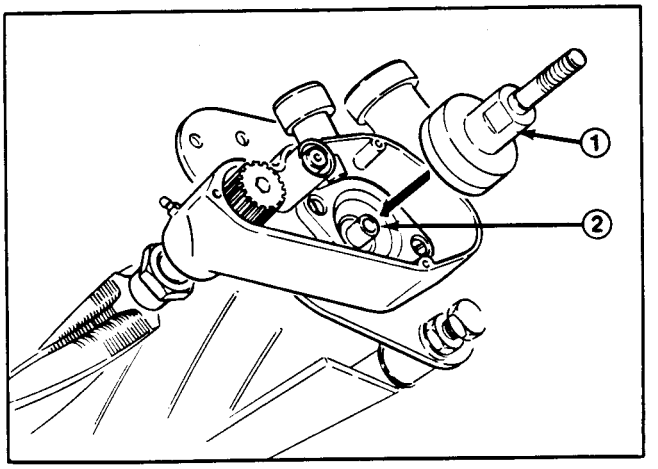


Figure 49

1. **Clutch adapter shaft**
2. **Reel shaft**

Installation and Assembly (Disassembled Clutch)

1. Pack bearings and area inside clutch body with No. 2 multi-purpose lithium base grease.

IMPORTANT: When assembling clutch, make sure belleville washers are installed correctly (Fig. 50).

2. Apply thick coating of grease to special screw (do not get on threads) and cam surface of clutch release disk. Apply "Loctite 271" or equivalent to threads of special screw before assembling to clutch pin. Assemble so clutch pin is 0.240 - 0.260 in. out from face of clutch body when pin is in fully extended position.

3. Install clutch adapter to reel shaft (Fig. 49). Tighten clutch adapter to a torque of 170 - 210 in-lb.

4. Hold belt on drive pulley of clutch and slide clutch on clutch adapter while sliding belt on driven pulley. Install washer and nut on clutch adapter shaft and tighten nut to a torque of 7 - 10 ft-lb.

5. Adjust belt tension. Install groomer reel housing cover (Fig. 39). Install clutch knob and tighten two (2) set screws against flats of clutch release disk.

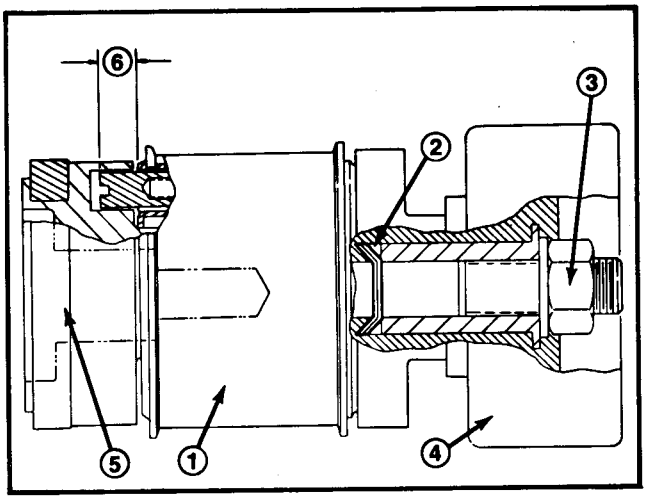


Figure 50

1. Clutch body/drive pulley
2. Belleville washer (2)
3. Nut and washer
4. Clutch engage/disengage knob
5. Clutch adapter
6. 0.250 in. ± 0.10 (pin extended)

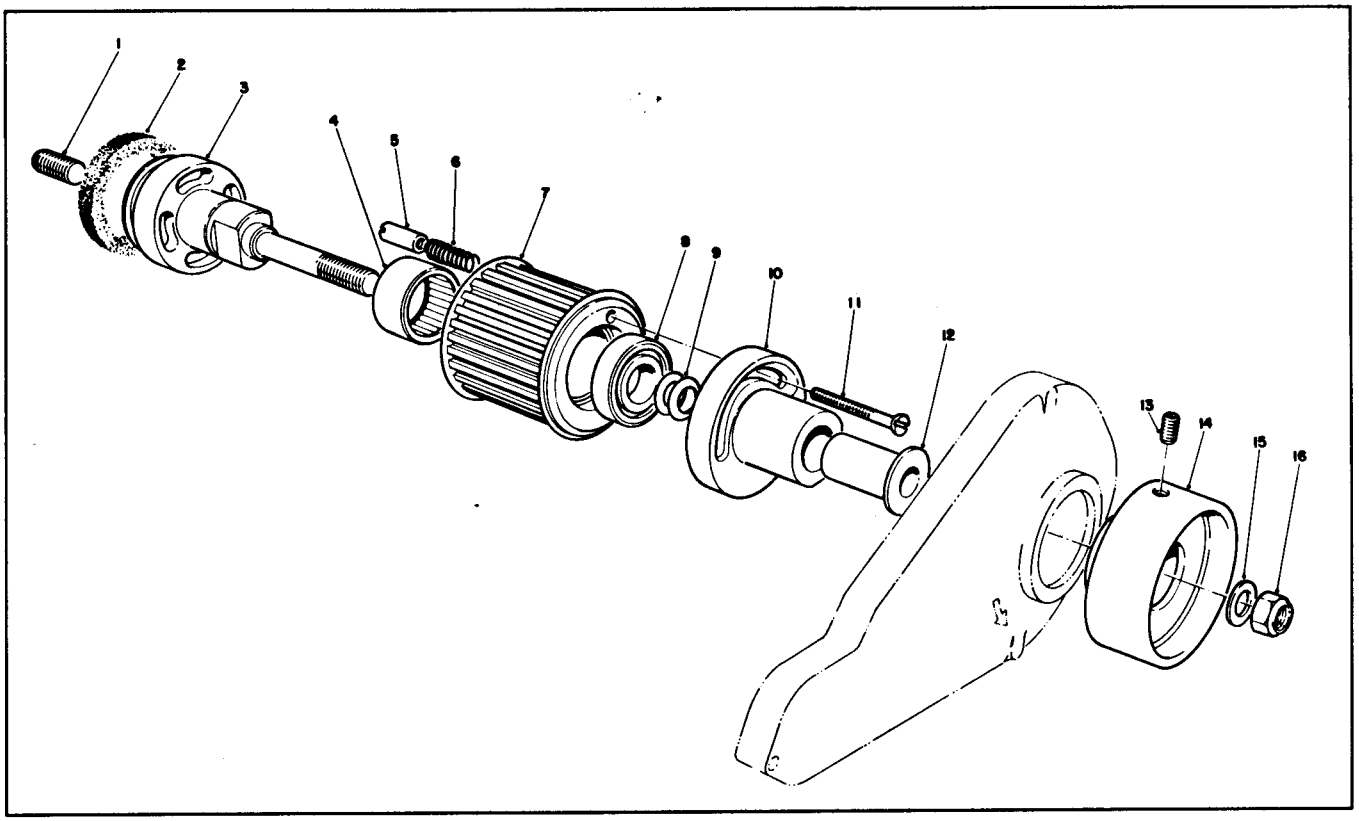


Figure 51

1. Set screw
2. Felt seal
3. Clutch adapter
4. Needle bearing
5. Clutch pin
6. Compression spring
7. Clutch body/drive pulley
8. Roller bearing
9. Belleville washer (2)
10. Clutch release disk
11. Special screw
12. Flange bushing
13. Set screw
14. Clutch knob
15. Flat washer
16. Lock nut

Bedknife to Reel Adjustment Knob Bearing Service

1. Turn bedknife adjustment knob counterclockwise to remove bedknife to reel contact.

2. Remove two (2) pivot screws (Fig. 38).

3. Rotate adjustment knob and pivot assembly clockwise (left-hand thread) until it is unthreaded from the bedbar pivot.

4. If necessary, remove locknut securing die spring to shaft (Fig. 6b). Slide pivot housing off adjustment knob threaded shaft (Fig. 38).

5. Pull inner races from pivot housing. Pull bearings from pivot housing. Check condition of inner races and bearings and replace if necessary.

6. Install new o-ring on each race if necessary.

7. Install bearings and races in pivot housing. Slide pivot housing onto shaft of knob.

8. Install spring over adjusting knob threaded shaft and thread adjustment knob and pivot assembly into flat side of bedbar pivot. Make sure there is an equal gap between each side of pivot assembly housing and frame supports (Fig. 29). Adjust (before installing pivot screws) by sliding bedbar pivot sideways.

IMPORTANT: On hand-adjustable type knobs, check to make sure die spring is compressed to a dimension of 13/16 in. by tightening locknut (left-hand thread) (Fig. 6b).

9. If equipped with hex head type pivot screws, tighten pivot screws to 60 ft-lb. If equipped with hex socket head set screws and jam nuts, tighten set screws finger tight then tighten 1/2 turn more (total - not each). Tighten jam nut.

10. Adjust bedknife to reel contact.

NOTE: If quality of cut has deteriorated or the reel and bedknife have become "rifled" , you must grind the reel and bedknife to remove rifle pattern.

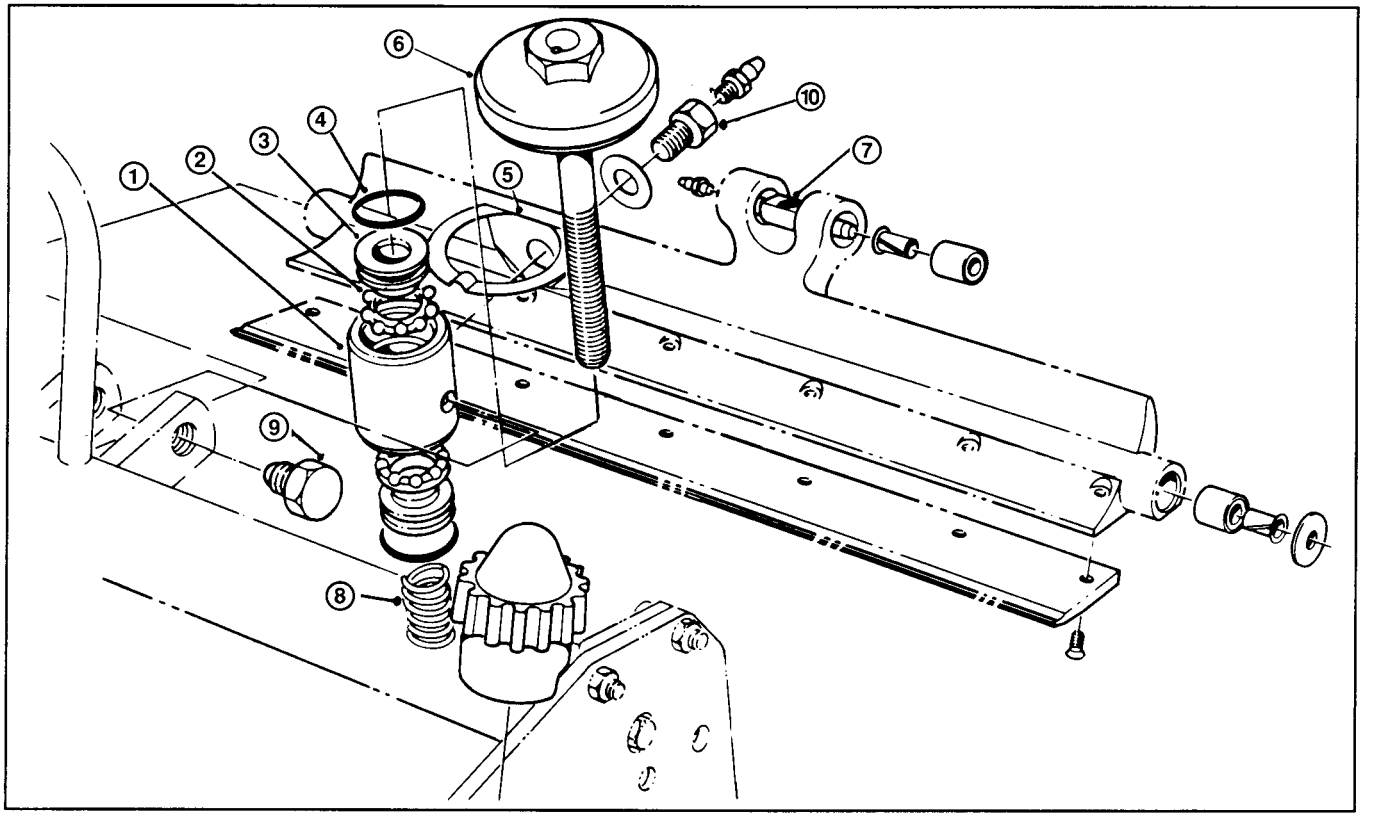


Figure 52

1. Pivot housing
2. Bearing (2)
3. Inner race (2)
4. O-ring (2)
5. Spring arm
6. Adjustment knob
7. Bedbar pivot
8. Spring
9. Pivot screw (2)
10. Spring arm retaining capscrew

Lift Bail Replacement

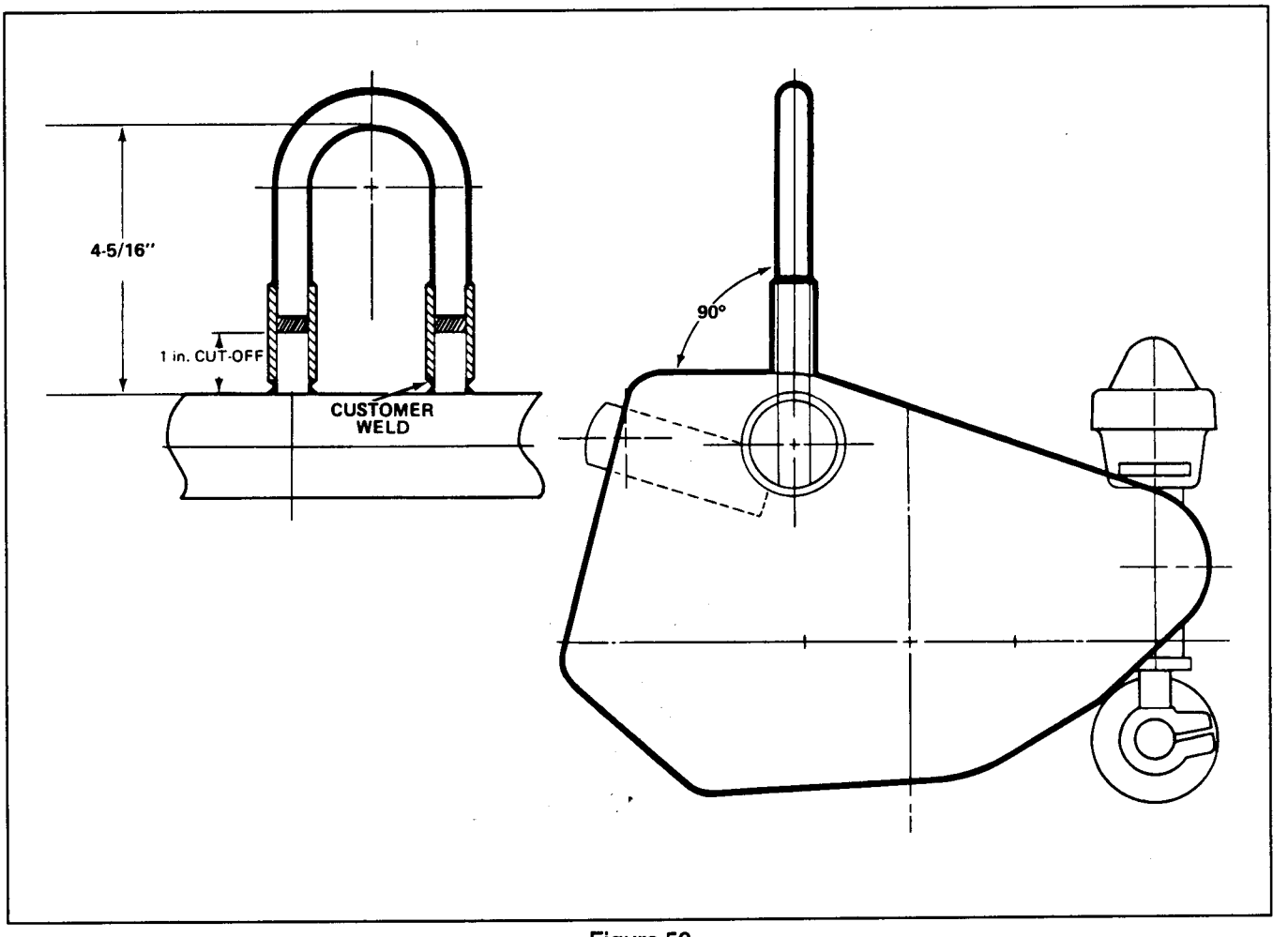


Figure 53

1. Use a saw to cut the lift bail off of the cutting unit. Make the cut 1 inch from the horizontal frame tube (Fig. 53).

2. Use a grinder to remove burrs from the stubs of the lift bail remaining on the cutting unit.

3. Install the repair lift bail (Part No. 71-1600).

4. Support the lift bail so the bottom radius is 4 5/16 inches from the top of the horizontal frame tube. Make sure the lift bail is square to the side frame.

5. Weld all around the bottom of the repair lift bail with mild steel rod, both sides.

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Chapter 10

Dual Point Adjust Cutting Units

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Specifications

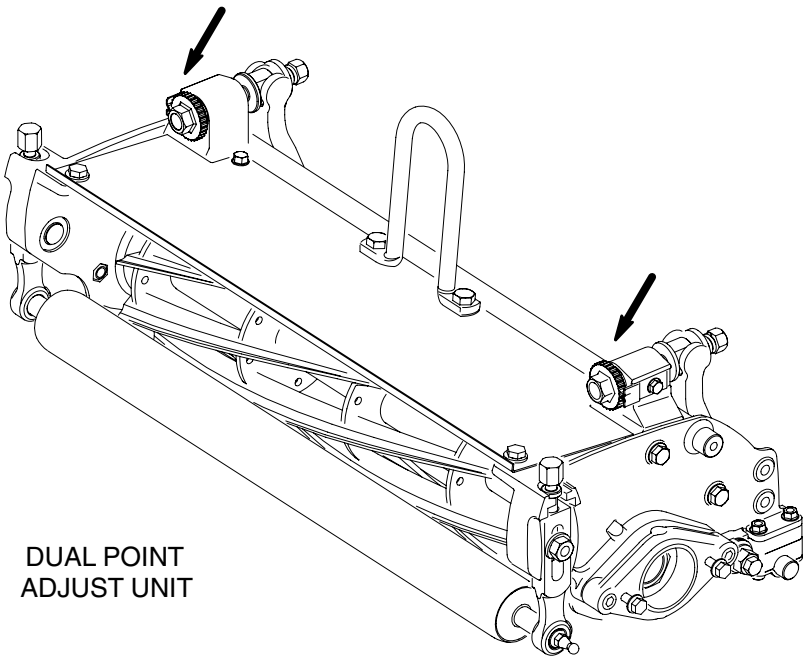

Figure 1

Height–of–Cut (HOC): Cutting height is adjusted on the front roller by two vertical screws and held by two locking capscrews. Standard bench height of cut range is .062 inch (1.6 mm) to .375 inches (9.5 mm) depending on type of bedknife installed. Bench height of cut range with the High Height of Cut Kit installed is .285 inch (7 mm) to 1 inch (25 mm). Effective HOC may vary depending on turf conditions, type of bedknife, rollers and attachments installed.

Reel Construction: Reels are 5 inches (13 cm.) in diameter, 21 inches (53.3 cm.) in length. High strength low alloy steel blades are thru hardened and impact resistant. Reels are available in 8 and 11 blade configurations.

Reel Bearings: Two double row self–aligning ball bearings, 30 +/–.1 mm inside diameter slip fit onto reel shaft with lock nut. Additional inboard and outboard seals for added protection. Reel position maintained by a wave washer with no adjusting nut.

Reel Drive: The reel weldment shaft is a 1.375 inch diameter tube with drive inserts permanently pressed in both ends. A replaceable floating coupler with an internal eight tooth spline is factory installed on the right end, and held in place by a snap ring.

Frame Construction: Precision machined die cast aluminum cross member with two bolt–on die–cast aluminum side plates.

Bedknife: Replaceable single edged, high carbon steel bedknife is fastened to a machined cast iron bedbar with 13 screws. Tournament bedknife is standard.

Bedknife Adjustment: Dual screw adjustment to the reel; detents corresponding to .0007 inch (.018 mm) bedknife movement for each indexed position.

Front Roller: A variety of sealed bearing and through–shaft front rollers are available for use with these cutting units. The front roller brackets control the height-of-cut by using two vertical adjustment screws, and are held in position by a horizontal locking screw.

Rear Roller: Steel full, 2 inch (5.1 cm.) diameter with sealed bearings and through–shaft. The rear roller has two positions, allowing user to change the cutting unit attitude and the behind center distance of bedknife from reel center line.

Counterbalance Weight: A cast iron weight mounted opposite to the drive motor balances the cutting unit.

Grass Shield: Non–adjustable shield with adjustable cut–off bar to improve grass discharge from reel in dry conditions.

Maximum Reel Speed: 2200 RPM

Weight:	8 Blade	72 lb. (32 kg)
	11 Blade	75 lb. (34 kg)

Special Tools

OTC (Owatonna Tool Company) supplies special tools for servicing Toro Commercial Products. The *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE* shows service tool applications.

Some tools may have been supplied with your mower or available as TORO parts. Some tools may also be available from a local supplier.

Gauge Bar Assembly

Used to verify height–of–cut.

Toro Model Number: **13–8199**

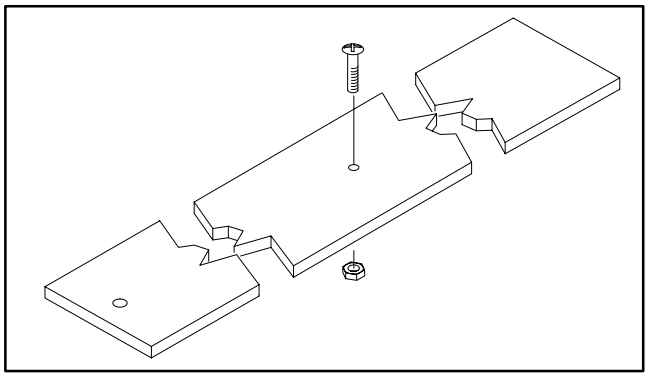

Figure 2

Backlapping Brush Assembly

Used to apply lapping compound to cutting units while keeping the operator's hands at a safe distance from the rotating reel.

Toro Model Number: **TOR299100**

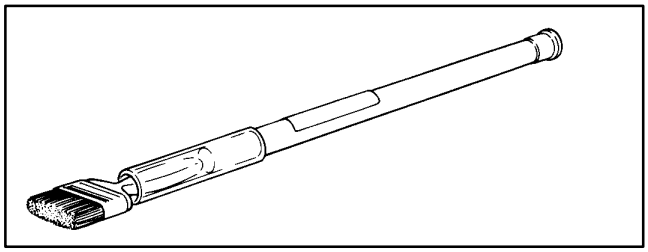

Figure 3

Bedknife Screw Tool

This screwdriver–type bit is made to fit Toro bedknife attaching screws. Use this bit with a torque wrench to secure the bedknife to the bedbar.

IMPORTANT: DO NOT use and air or manual impact wrench with this tool so damage to the bedbar will be prevented.

Toro Model Number: **TOR510880**

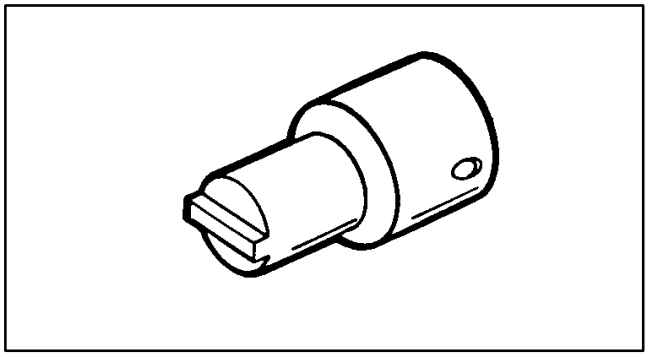

Figure 4

Inner Grease Seal Installation Washer

inner grease seal installation washer Toro Part Number 104-0532

This washer is used when replacing the reel bearing inner grease seal. It enables pressing the grease seal to a depth of .104 in. (2.64 mm) below the surface of the cutting unit side plate.

Toro Part Number: **104-0532**

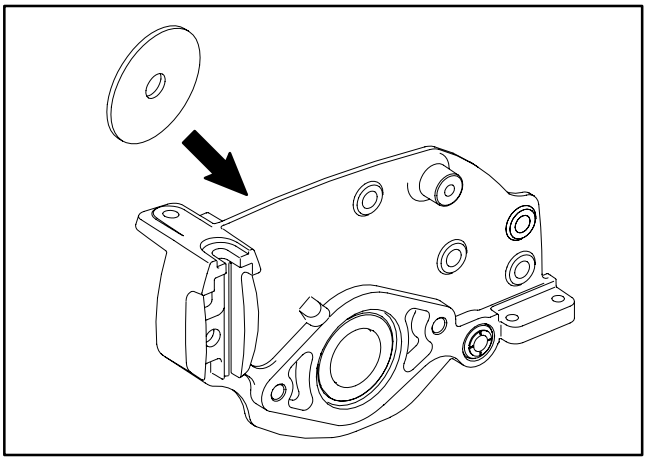

Figure 5

Plastic Plug

This cap is used for placement into the bearing housing when the reel motor is removed. It prevents dirt and debris from entering the housing.

Toro Part Number: **2410–30**

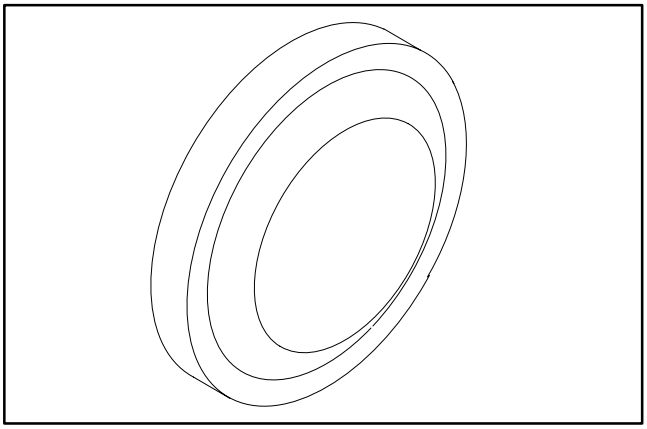

Figure 6

Turf Evaluator Tool

Many turf discrepancies are subtle and require closer examination. In these instances, the Turf Evaluator grass viewing tool is helpful. It can assist turf managers and service technicians in determining causes for poor reel mower performance and in comparing the effective height–of–cut of one mowed surface to another. This tool should be used with the Toro Guide to Evaluation Reel Mower Performance and Using the TurfEvaluator (Toro part no. 97931SL)

Toro Model Number: **04399**

Figure 7

Troubleshooting

There are a number of factors that can contribute to unsatisfactory quality of cut, some of which may be turf conditions. Turf conditions such as excessive thatch, “sponginess” or attempting to cut off too much grass height may not always be overcome by adjusting the cutting unit. It is important to remember that the lower the height–of–cut, the more critical these factors are. See Adjustments in the Cutting Unit Operator’s Manual and the Service and Repairs section in this chapter of this manual for detailed adjustment and repair information.

For additional information regarding cutting unit troubleshooting, see Aftercut Appearance Troubleshooting Aid (Toro part no. 00076SL).

Factors That Can Affect Quality of Cut

Factor	Possible Problem/Correction
Tire pressure	Check pressure of all tires. Pressure must be equal on both front tires. Adjust pressure as necessary. See Chapter 6 – Wheels and Brakes.
Governed engine speed	Check maximum governed engine speed. Adjust engine to specifications if necessary. See Maintenance section in the Traction Unit Operator’s Manual, and/or the Briggs & Stratton Repair Manual for 4-cycle V-Twin Cylinder OHV Head Engines
Reel speed	All reels must rotate at the same speed (within 100 rpm). All cutting units must have equal bedknife to reel and height–of–cut adjustments. Check reel speed setting if an optional backlap/variable reel speed kit is installed. See Troubleshooting in Chapter 4 – Hydraulic System in this manual.
Reel bearing condition	Check bearings for wear and replace if necessary. See Reel and Bearing Removal and Installation in this chapter of this manual.
Reel and bedknife sharpness	A reel and/or bedknife that has rounded cutting edges or “rifling” (grooved or wavy appearance) **cannot** be corrected by tightening the bedknife to reel contact. Grind reel to remove taper and/or rifling. Grind bedknife to sharpen and/or remove rifling. The most common cause of rifling is bedknife to reel contact that is too tight. **A new bedknife must be ground or backlapped after installation to the bedbar.**

Factor	Possible Problem/Correction
Bedknife to reel adjustment	Check bedknife to reel contact daily. The bedknife must have light contact across the entire reel. No contact will dull the cutting edges. Excessive contact accelerates wear of both edges. Quality of cut is adversely affected by both conditions (see Bedknife to Reel Adjustment in the Cutting Unit Operator's Manual). Slightly dull cutting edges may be corrected by backlapping (see Backlapping in this chapter of this manual). Excessively dull cutting edges must be corrected by grinding the reel and bedknife (see Preparing Reel for Grinding in this chapter of this manual).
Rear roller adjustment	Adjust the rear roller brackets to hi or low position depending on the height-of-cut range desired. See Rear Roller Adjustment in the Cutting Unit Operator's Manual.
Height–of–cut	"Effective" or actual height–of–cut depends on the cutting unit weight and turf conditions. Effective height–of–cut will be different from the bench set height–of–cut. See Height–of–Cut Adjustment in the Cutting Unit Operator's Manual.
Proper bedknife selection for height–of–cut desired	If the bedknife is too thick for effective height–of–cut, poor quality of cut will result.
Stability of bedbar	Make sure bedbar pivot bolts are seated securely. Check condition of the bushings in the side plates. See Bedbar Removal and Installation in this chapter of this manual.
Number of reel blades	Use correct number of blades for clip frequency and optimum height–of–cut range.
Cutting unit alignment and pull frame ground following	Check pull frames and lift arms for damage, binding, or bushing wear. Repair if necessary.
Roller condition	Make sure rollers rotate freely. Repair bearings as necessary. See Roller Bearing Replacement in the Service and Repairs section in this chapter of this manual.
Cutting Unit drop speed and sequence	Rear cutting unit must drop after front cutting units. See Rear Lift Cylinder Flow Control Valve in Chapter 4 – Hydraulic System in this manual.

Characteristics

CAUTION

Never install or work on the cutting units or lift arms with the engine running. Always stop engine and remove key first.

The dual knob bedknife–to–reel adjustment system incorporated in this cutting unit simplifies the adjustment procedure needed to deliver optimum mowing performance. The precise adjustment possible with this design gives the necessary control to provide a continual self–sharpening action. This feature maintains sharp cutting edges, assures good quality of cut, and greatly reduces the need for routine backlapping.

In addition, the rear roller positioning system allows for two height-of-cut ranges.

If a cutting unit is determined to be out of adjustment, complete the following procedures in the specified order to adjust the cutting unit properly.

1. Adjust the bedknife parallel to the reel.

2. Determine desired height of cut range and install rear roller mounting shim accordingly.

3. Adjust the height-of-cut.

4. Adjust the cut-off bar.

See Cutting Unit Operator's Manual for adjustment procedures for the cutting units on the Greensmaster 3150.

Hydraulic Reel Motor

IMPORTANT: When performing maintenance procedures on the cutting units, store the cutting unit reel motors in support tubes on the frame to prevent damage to the hoses. Do not raise suspension to transport position when the reel motors are in the holders in the traction unit frame. Damage to the motors or hoses could result.

Removal

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove basket from carrier frame.

3. Loosen flange head screws that secure the hydraulic motor to the motor adapter plate. Rotate motor clockwise, and remove motor.

4. Place protective plastic cap (see Special Tools) into the hole in the motor adapter plate.

Inspection

1. Check reel drive coupler splines for wear. Replace if necessary (see Reel Removal and Installation in this chapter of this manual).

Installation

1. Coat spline shaft of the motor with clean No. 2 multipurpose lithium base grease.

2. Install the flange head screws for the reel drive motor into the motor adapter plate and leave approximately 1/2 inch (12.7 mm) of threads exposed on each screw.

3. Install motor by rotating the motor clockwise so the motor flanges clear the flange head screws.

4. Rotate the motor counterclockwise until the motor flanges are encircling the flange head screws. Tighten flange head screws.

Backlapping (Units without Optional Backlap/Variable Reel Speed Kit)

CAUTION

Be careful when backlapping the reel because contact with the reel or other moving parts can result in personal injury.

1. Remove reel motors from the cutting units and cutting units from the lift arms and pull frame (see Cutting Unit Removal and Installation).

2. Connect the backlapping machine to the cutting unit by inserting a piece of 3/8–inch socket extension drive into the splined reel drive coupling.

3. Attach backlap motor or drive to the socket extension.

4. Follow instructions and procedures for backlapping in the Toro Service Training Book, Sharpening Reel and Rotary Mowers, part no. 80300SL.

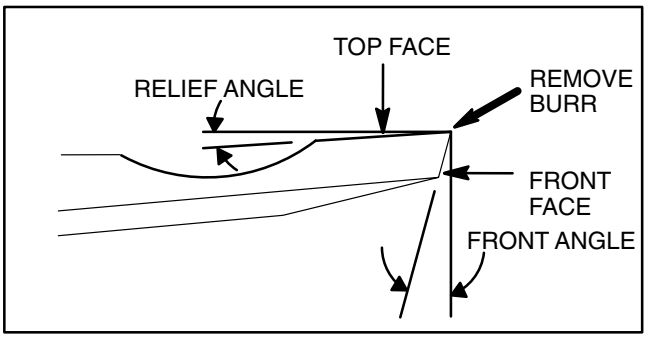

Figure 8

Note: For a better cutting edge, run a file across the front face of the bedknife when the lapping operation is completed. This will remove any burrs or rough edges that may have built up on the cutting edge.

Backlapping (Units with Optional Backlap/Variable Reel Speed Kit)

DANGER

TO AVOID PERSONAL INJURY OR DEATH:

- **Never place hands or feet in the reel area while the engine is running.**
- **While backlapping, the reels may stall and then restart.**
- **Do not attempt to restart reels by hand or foot.**
- **Do not adjust reels while the engine is running.**
- **If a reel stalls, stop engine before attempting to clear the reel.**
- **Reel motors are connected in series, moving one motor moves the other two.**

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Move functional control lever to the Neutral/Backlap position.

IMPORTANT: Do not attempt to rotate the directional valve knob when the machine or reels are running.

3. Raise seat and rotate directional valve knob fully clockwise to the backlap position.

4. Rotate flow control valve knob to position 6.

5. On all cutting units, make initial reel to bedknife adjustments appropriate for backlapping (see Bedknife to Reel Adjustment in Cutting Unit Operator's Manual).

6. Start engine and move Raise / Lower – Mow control forward to start the reels.

7. Rotate flow control valve knob to position 1.

8. Apply lapping compound with a long handled brush (see Special Tools).

CAUTION

Be careful when backlapping the reel because contact with the reel or other moving parts can result in personal injury.

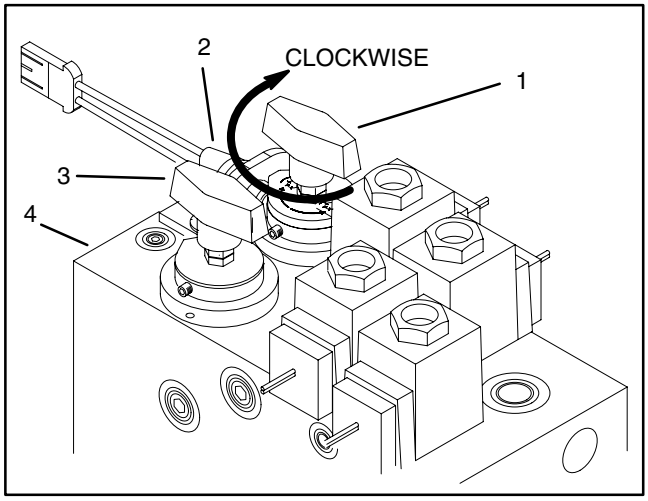

Figure 9

1. **Directional valve knob**
2. **Ball switch**
3. **Flow control valve knob**
4. **Hydraulic manifold**

9. To make an adjustment to the cutting units while backlapping, turn reels OFF by moving the RAISE/LOWER–MOW control to the RAISE position. Shut off engine. After the adjustments have been completed, repeat steps 4 through 6.

10. When the backlap operation is completed, shut off engine and rotate directional valve knob counter–clockwise fully (90° from the backlap position) to forward position. Also, rotate flow control valve knob to position 13 for height–of–cut settings of a 1/4 inch or below.

Note: For additional settings, refer to the instructions on the decal that is located on the underside of the seat support.

11. Wash all lapping compound off the cutting units.

12. For a better cutting edge, run a file across the front face of the bedknife when the lapping operation is completed. This will remove any burrs or rough edges that may have built up on the cutting edge.

Note: Additional instructions and procedures on backlapping are available in the Toro Service Training Book, Sharpening Reel and Rotary Mowers, part no. 80300SL.

Bedbar Assembly

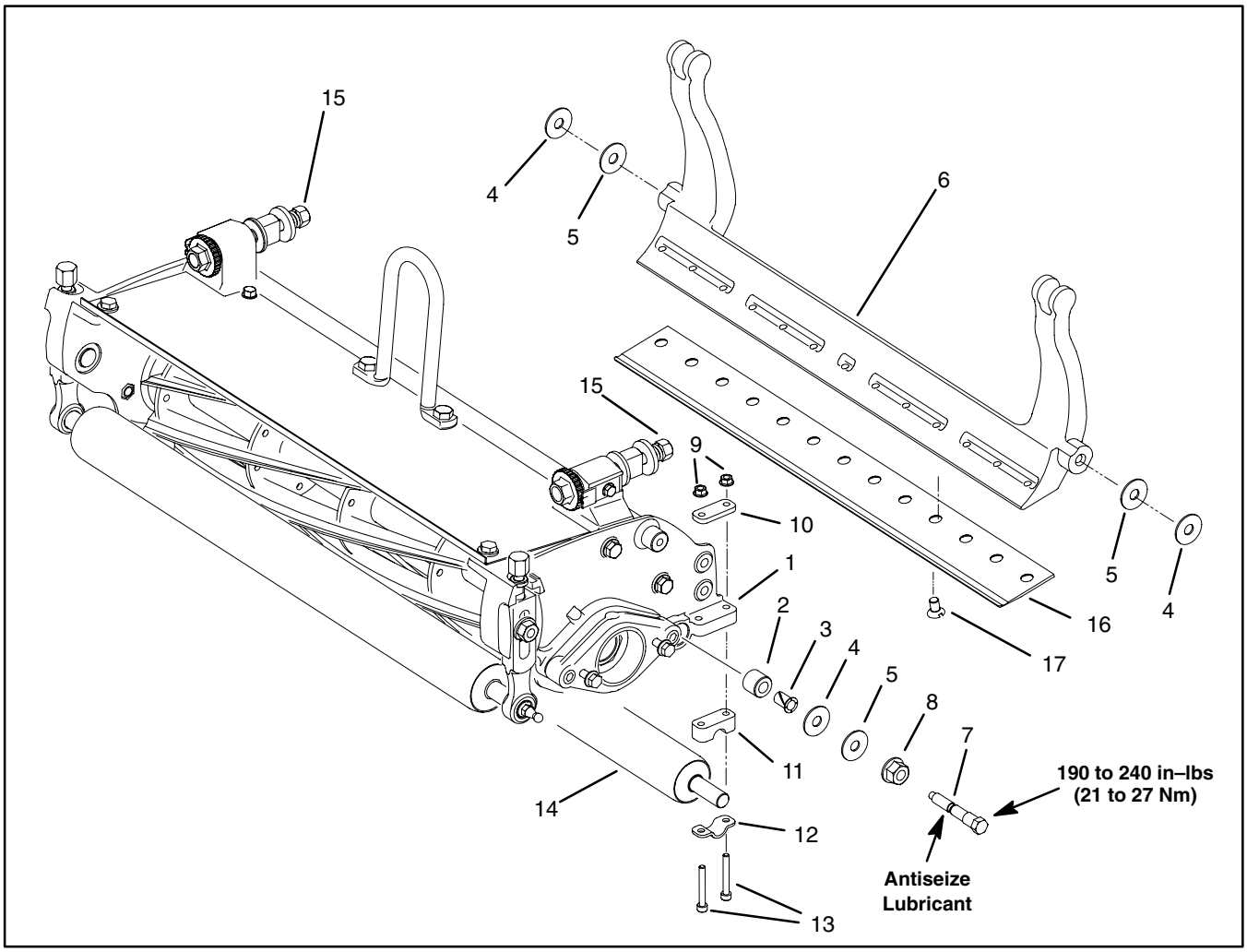

Figure 10

1. Side plate
2. Rubber bushing
3. Flange bushing
4. Washer (plastic)
5. Washer (metal)
6. Bedbar
7. Bedbar pivot bolt
8. Flange nut
9. Flange nut
10. Shim
11. Spacer
12. Retainer
13. Cap screw
14. Rear roller assembly
15. Lock nut
16. Bedknife
17. Bedknife screw

Bedbar Removal and Installation

Removal (Fig. 10)

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove the basket from the cutting unit carrier frame.

3. Disconnect the drive motor from the cutting unit.

4. Disconnect the cutting unit from the pull link.

5. Unhook the cutting unit from the lift arm and slide the cutting unit out from under the carrier frame.

6. Loosen the two lock nuts (15) on the end of each bedbar adjuster assembly.

7. Loosen the two flange nuts (8) on each bedbar pivot bolt (7).

8. Remove the two bedbar pivot bolts (7), and each of the washers (4 and 5) from the outside of the cutting unit side plates.

9. Remove the bedbar (6) and each of the washers (4 and 5) from the inside of the cutting unit side plates.

10. Inspect flange bushings (3) and remove if necessary.

11. Inspect rubber bushings (2) and remove if necessary.

Installation (Fig. 10)

1. If either rubber bushing (2) was removed from the side plate, install a new bushing. The bushing should be installed flush with the inside of the side plate (Fig. 11).

2. Install the flange bushings (3) with flange facing outward.

3. Thread the flange nuts (8) all the way up to the head of each bedbar pivot bolt (7) and apply antiseize lubricant to the threads of each bedbar pivot bolt (7).

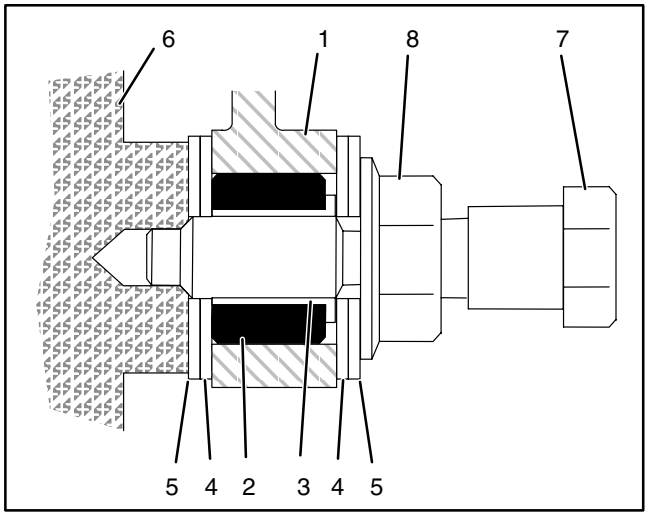

Figure 11

1. **Sideplate**
2. **Rubber bushing**
3. **Flange bushing**
4. **Washer (plastic)**
5. **Washer (metal)**
6. **Bedbar**
7. **Bedbar pivot bolt**
8. **Flange nut**

4. Slide one metal washer (5) and one plastic washer (4) onto each bedbar pivot bolt. The metal washer (5) must contact the flange nut (8) (Fig. 11).

5. Position bedbar (6) into cutting unit. Slide the top of the bedbar arms between washers on each adjuster assembly.

6. Position one metal washer (5) and one plastic washer (4) between bedbar and each side plate. The metal washer (5) must contact the bedbar (Fig. 11).

7. Install the bedbar pivot bolt assemblies. Tighten each bedbar pivot bolt from **190 to 240 in–lbs (21 to 27 Nm)**.

8. Tighten both flange nuts (8) to remove end play at the outer washers. Do not over tighten the flange nuts or distort the side plates.

9. Tighten the lock nut (15) on each bedbar adjuster assembly until the adjuster spring is fully compressed, then loosen lock nut 1/2 turn.

10. Adjust cutting unit (see Cutting Unit Operator's Manual).

Bedbar Adjuster Service

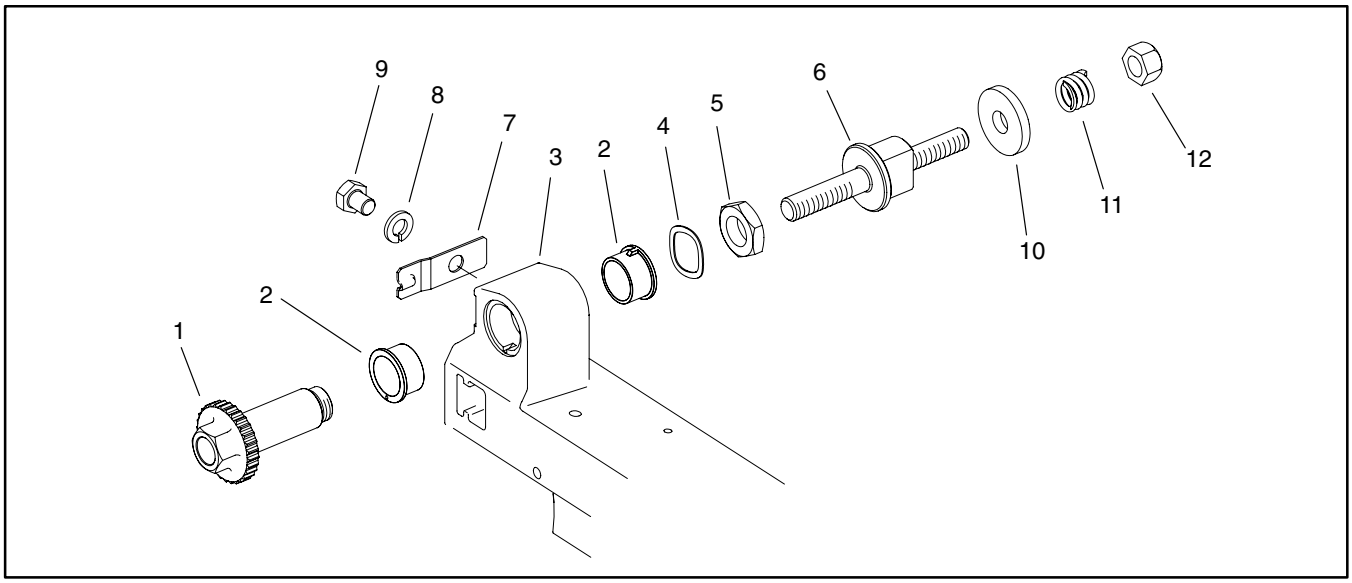

Figure 12

1. **Adjuster shaft**
2. **Flange bushing**
3. **Cutting unit frame**
4. **Wave washer**
5. **Jam nut**
6. **Adjuster screw**
7. **Detent**
8. **Lock washer**
9. **Cap screw**
10. **Washer**
11. **Spring**
12. **Lock nut**

Removal (Fig. 12)

1. Remove bedbar (see Bedbar Removal in this section of this manual).

2. Remove locknut (12), spring (11), and washer (10) from adjuster screw.

3. Unscrew adjuster (6) from the adjuster shaft (1).

4. Remove jam nut (5) and wave washer (4) from adjuster shaft and remove adjuster shaft from cutting unit frame.

5. Inspect flange bushings (2) and remove if necessary.

6. If the detent (7) is damaged, remove it from the cutting unit frame by removing the cap screw (9) and lock washer (8).

Installation (Fig. 12)

1. If the detent (7) was removed, install the cap screw (9) and secure detent to the cutting unit frame with cap screw and lock washer.

2. If flange bushings (2) were removed, align key on bushing to slot in frame and install bushings.

3. Apply antiseize lubricant on internal threads of adjuster shaft (1) and slide into flange bushings in cutting unit frame.

4. Install wave washer (4). Apply Loctite 242 or equivalent to the threads of the jam nut (5). Tighten jam nut from **15 to 20 ft–lbs (20 to 27 Nm).**

5. Screw adjuster (6) into adjuster shaft.

6. Install washer (10), spring (11), and lock nut (12) onto adjuster screw.

7. Install bedbar (see Bedbar Installation in this section of this manual).

8. Adjust cutting unit (see Cutting Unit Operator's Manual).

Bedknife Replacement and Grinding

Removal

1. Remove bedbar from frame (see Bedbar Removal).

2. Remove screws from bedbar using a socket wrench and bedknife screw tool (see Special Tools). Discard screws. Remove bedknife from the bedbar (Fig. 13).

3. Use scraper to remove all rust, scale and corrosion from bedbar surface before installing bedknife.

Replacement

1. Make sure bedbar threads are clean. Use new screws. Apply clean SAE 30 oil to the screws before installing.

IMPORTANT: Do not use an impact wrench to tighten screws into the bedbar.

2. Using a torque wrench and bedknife screw tool, tighten screws to a torque of 200 to 250 in–lb (22 to 28 Nm). Use a torquing pattern working from the center toward each end of the bedknife (Fig. 14).

3. Install bedbar to frame (see Bedbar Installation).

Grinding

Since there can be variations in the mounting surface of the bedbar, a new bedknife will not be perfectly flat after it is installed. Because of this, it is necessary to backlap or grind a new bedknife after installing it to the bedbar. Follow the existing angle that was ground into the bedknife and grind only enough to make sure the top surface is true (Fig. 15).

1. Remove bedbar from the cutting unit (see Bedbar Removal).

Note: When grinding, be careful to not overheat the bedknife. Remove small amounts of material with each pass of the grinder.

2. Use Toro Service Training Book, Sharpening Reel and Rotary Mowers (part no. 80300SL) for bedknife grinding information.

Bedknife Grinding Specifications	
Bedknife relief angle	3° (see Fig. 15)
Front Angle	13°
Front Angle Range	13° to 17°

NOTE: Relief angle is 7° for special "extended" bedknives

3. Reinstall bedbar to cutting unit (see Bedbar Installation).

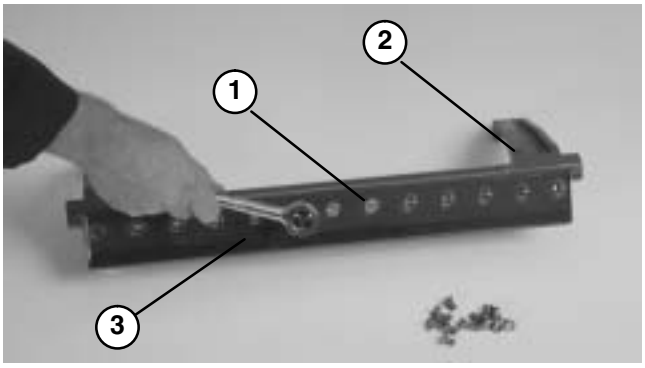

Figure 13

1. **Screw**
2. **Bedbar**
3. **Bedknife**

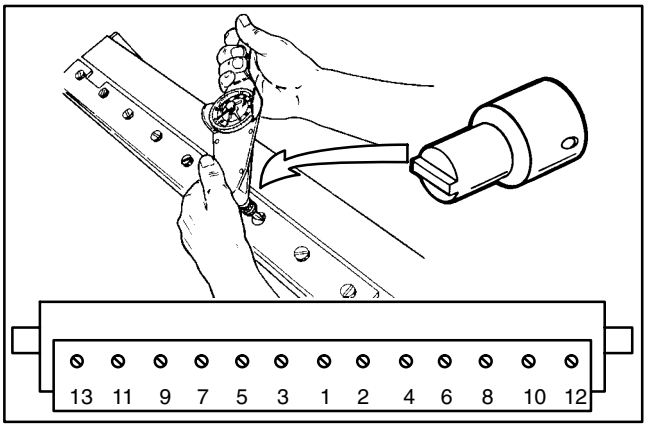

Figure 14

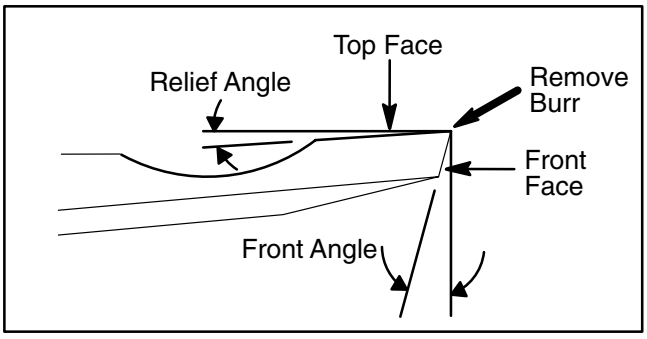

Figure 15

Reel Assembly

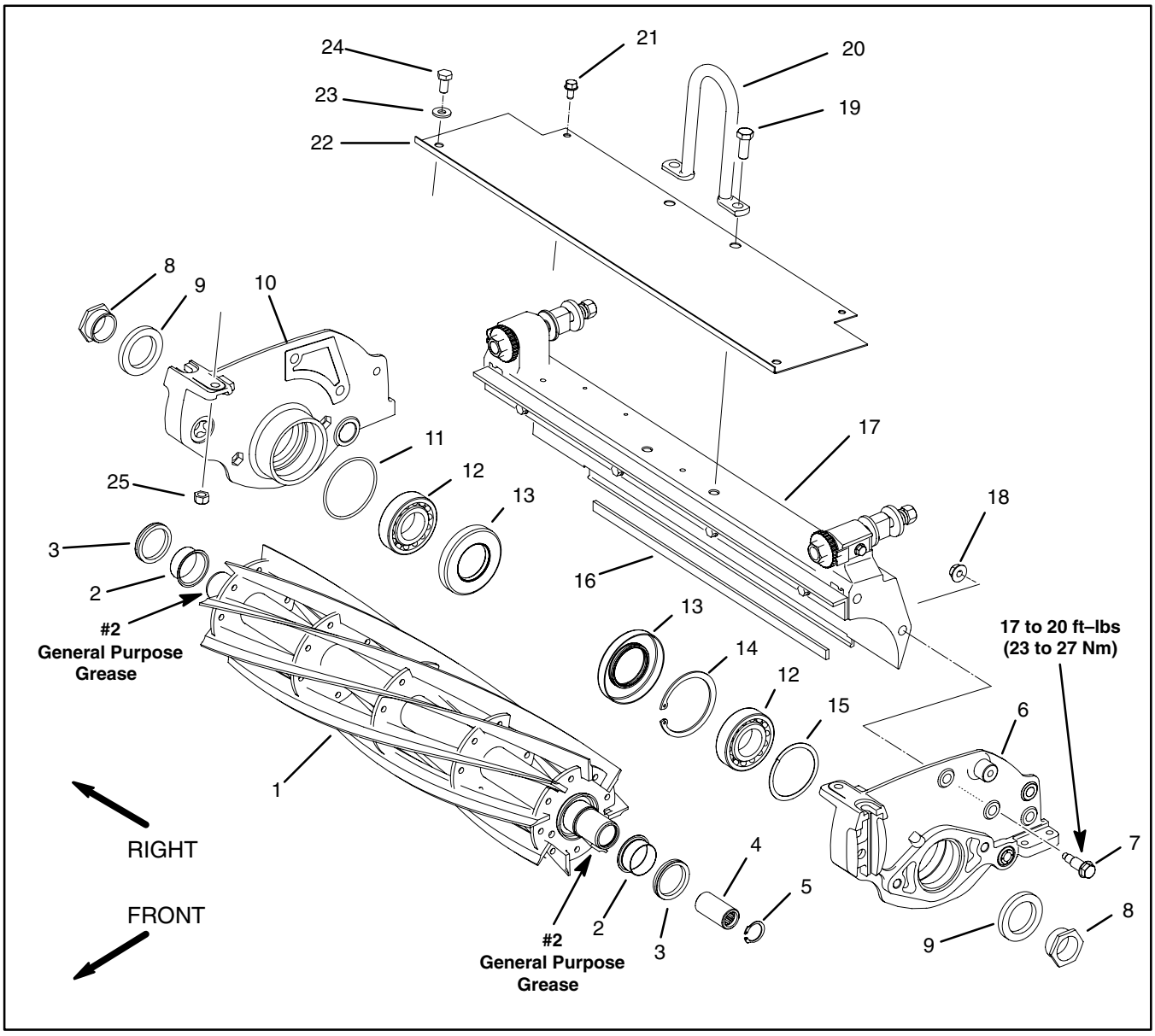

Figure 16

1. Reel
2. Speedi sleeve
3. V–ring
4. Drive coupler
5. Retaining ring
6. Left side plate assembly
7. Shoulder bolt
8. Bearing lock nut
9. Outer grease seal
10. Right side plate assembly
11. O–ring
12. Bearing
13. Inner grease seal
14. Retaining ring
15. Wave washer
16. Seal strip
17. Frame assembly
18. Flange nut
19. Cap screw
20. Lift hook
21. Cap screw
22. Grass shield
23. Washer
24. Cap screw
25. Lock nut

Reel Removal (Fig. 16)

1. Remove reel motor from the cutting unit (see Hydraulic Reel Motor Removal in this chapter).

2. Remove the 2 capscrews securing the counter weight to the side plate (Fig. 17). Remove the counter weight.

3. Remove the bedbar assembly (see Bedbar Removal in this chapter).

Note: Depending on tools available, it may be necessary to remove the reel motor adapter plate before removing the left end bearing lock nut (8).

4. Remove the reel bearing lock (8) nut from each end of the reel shaft.

5. Loosen the setscrews securing the front roller to the height of cut arms (Fig. 18). Do not remove the set screws.

6. Loosen the saddle strap screws and flange nuts securing the rear roller to the the side plates (Fig. 18). Do not remove the screws and nuts.

7. Remove the capscrew (24), washer (23) and lock nut (25) securing each end of the grass shield to the side plates. These are the only capscrews that must to be removed. The grass shield and the lift hook do not need to be removed.

8. Remove the 2 shoulder bolts (7) securing the right hand side plate to the cutting unit frame. Remove the side plate from the reel shaft and roller shafts.

9. Remove the 2 shoulder bolts (7) securing the left hand side plate to the cutting unit frame. Remove the side plate from the reel shaft and the roller shafts.

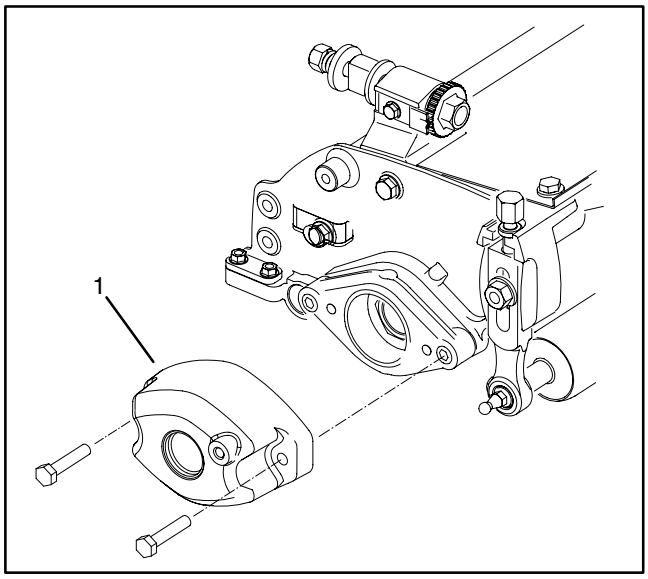

Figure 17

1. Counter weight

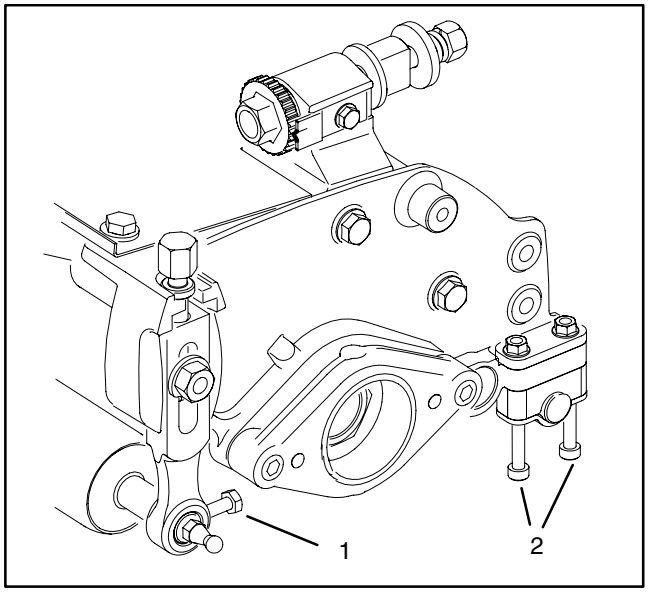

Figure 18

1. Front roller set screw

2. Rear roller saddle strap screws

Left Side Plate Service (Fig. 16)

1. Remove the inner grease seal (13) and outer grease seal (9) from the side plate (6).

2. Remove the retaining ring (14) securing the bearing in the side plate. Remove the bearing (12). Inspect the bearing to insure that it spins freely and has minimal axial play. The bearing balls must be free of deformation and scoring. Replace the bearing if necessary.

3. Remove the wave washer (15).

4. Remove all grease from the side plate bore.

5. Insert the wave washer (15) into the side plate.

Note: Replacemant Seal Kit (Toro Part No. 106-6937) is available for side plate service of dual point adjust cutting units.

6. Pack the bearing (12) with Mobil High Temperature HP or equivalent grease. Insert the bearing into the side plate against the wave washer.

7. Press the retaining ring (14) into the groove, slightly compressing the bearing and wave washer.

8. Pack the cavity of the inner seal (13) with Mobil High Temperature HP or equivalent grease.

9. Using inner grease seal installation washer (Toro Part Number 104-0532) press the inner seal (13) into the side plate until the washer is flush with the outer edge of the side plate bore. Remove the washer. When properly installed, the seal should be positioned .104 in. below the inner edge of the side plate bore.

10. Press the outer seal (9) into the side plate until it is flush with the the outer edge of the side plate bore.

IMPORTANT: The outer grease seal (9) should be installed so the lip is facing out. This helps keep contamination from entering, and allows grease to vent or purge out if necessary (Fig. 20).

11. Fill remaining voids, behind inner grease seal (13) and outer grease seal (9) lips with Mobil High Temperature HP or equivalent grease.

Right Side Plate Service (Fig. 16)

1. Remove the inner grease seal (13) and outer grease seal (9) from the side plate (10).

2. Remove the bearing (12). Inspect the bearing to insure that it spins freely and has minimal axial play. The bearing balls must be free of deformation and scoring. Replace the bearing if necessary.

3. Remove the O–ring (11) from the groove in the side plate bore.

4. Remove all grease from the side plate bore.

Note: Replacemant Seal Kit (Toro Part No. 106-6937) is available for side plate service of dual point adjust cutting units.

5. Insert the O–ring (11) into the groove in the side plate. Apply a light coating of grease onto the O–ring, after it is installed.

6. Pack the bearing (12) with Mobil High Temperature HP or equivalent grease. Insert the bearing into the side plate until it is against the bottom of the bore.

7. Pack the cavity of the inner seal (13) with Mobil High Temperature HP or equivalent grease.

8. Using inner grease seal installation washer (Toro Part Number 104-0532) press the inner seal (13) into the side plate until the washer is flush with the outer edge of the side plate bore. Remove the washer. When properly installed, the seal should be positioned .104 in. below the inner edge of the side plate bore.

9. Press the outer seal (9) into the side plate until it is flush with the the outer edge of the side plate bore.

IMPORTANT: The outer grease seal (9) should be installed so the lip is facing out. This helps keep contamination from entering, and allows grease to vent or purge out if necessary (Fig. 20).

10. Fill remaining voids, behind inner grease seal (13) and outer grease seal (9) lips with Mobil High Temperature HP or equivalent grease.

Reel Service (Fig. 16)

Note: Install new reel components on each end of the reel shaft that mates with newly serviced side plate components.

1. Remove the retaining ring (5) and the drive coupler (4) from the end of the reel shaft.

2. Remove the V–ring (3) from the reel shaft.

3. Using a flat blade screw driver or similar tool, remove the speedi sleeve (2) from the reel shaft.

Note: Replacemant Seal Kit (Toro Part No. 106-6937) is available for reel service of dual point adjust cutting units.

4. Inspect the reel shaft as follows:

   A. Check the reel shaft for bending and distortion by placing the shaft ends in V–blocks. Replace the reel if necessary.

   B. Check the reel blades for bending or cracking Replace the reel if necessary.

   C. Check the drive adapter inside of the reel shaft (Fig. 19). The adapter should be free of bending and distortion. Check the splines for excessive cracks or distortion. Replace the reel if necessary.

   D. Check the service limit of the reel diameter. Replace the reel if necessary.

5. Using an appropriate I.D. tube or sleeve, press the speedi sleeve onto the reel shaft until it bottoms out on the spider cup (Fig. 20).

IMPORTANT: Do not nick or scratch the Speedi sleeve surface as seal failure could result.

6. Slide the V–ring onto the reel shaft with the thick shoulder of the V–ring facing inward (Fig. 20).

7. Fill the drive coupling (4) 1/2 to 1/3 full with Mobil High Temperature HP or equivalent grease. Also, coat the outside of the drive coupling with grease.

8. Install the retaining ring (5). Make sure it is seated into the groove.

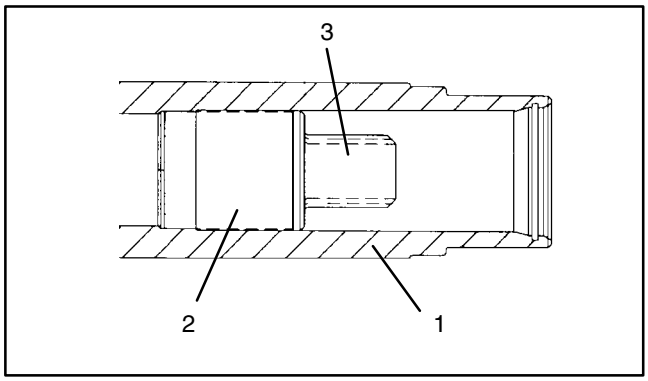

Figure 19

1. **Reel shaft**
2. **Drive adapter**
3. **Adapter spline**

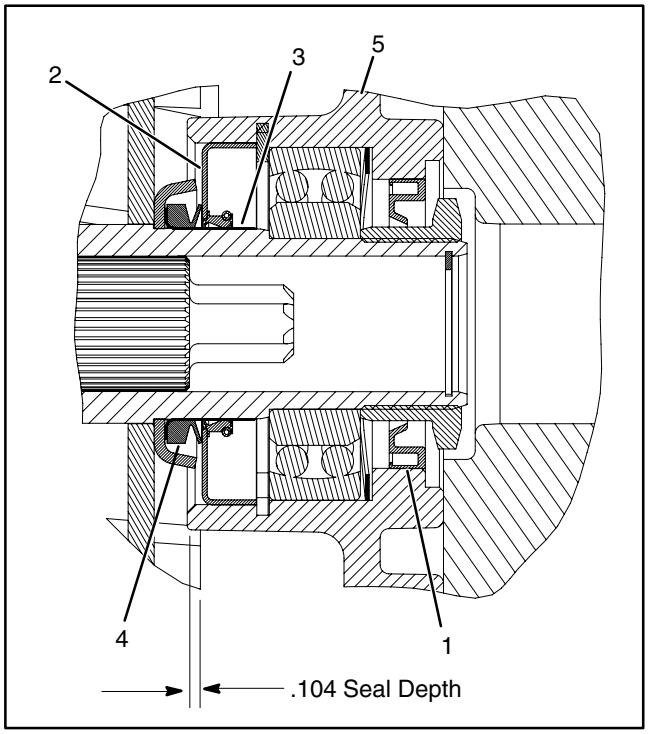

Figure 20

1. **Outer seal**
2. **Inner seal**
3. **Speedi sleeve**
4. **V-ring**
5. **Left side plate**

Reel Installation (Fig. 16)

IMPORTANT: Wipe any excess grease from the inner grease seals (13) where the reel shaft V–rings (3) make contact. The V–rings should run dry.

1. Slide the left hand side plate (6) onto the reel shaft. Make sure the reel shaft threads do not damage the grease seals in the side plate.

2. Apply a film of No. 2 general purpose grease to the reel shaft threads and install the left side reel bearing locknut (8).

3. Slide the right hand side plate (10) onto the reel shaft. Make sure the reel shaft threads do not damage the grease seals in the side plate.

4. Apply a film of No. 2 general purpose grease to the reel shaft threads and install the right side reel bearing locknut (8).

5. Mount the frame assembly (17) to the side plates with the four shoulder bolts (7). Torque the shoulder bolts to **17 to 20 ft-lbs. (23 to 27 Nm).**

6. Secure the grass shield (22) to the side plates with two capscrews (24), washers (23), and lock nuts (25).

7. Torque the reel bearing locknuts (8) to **50 to 60 ft-lbs. (68 to 81 Nm).**

8. Install the bedbar assembly (see Bedbar Installation in this chapter).

9. Install the rear roller as follows (Fig. 21):

   A. On one of the saddle clamps, remove one of the screws and nuts securing it to the side plate.

   B. Install rear roller into saddle clamps and loosely secure it with the screw and nut previously removed.

   C. Center the roller between side plates. Tighten the saddle clamp screws and nuts to secure the roller.

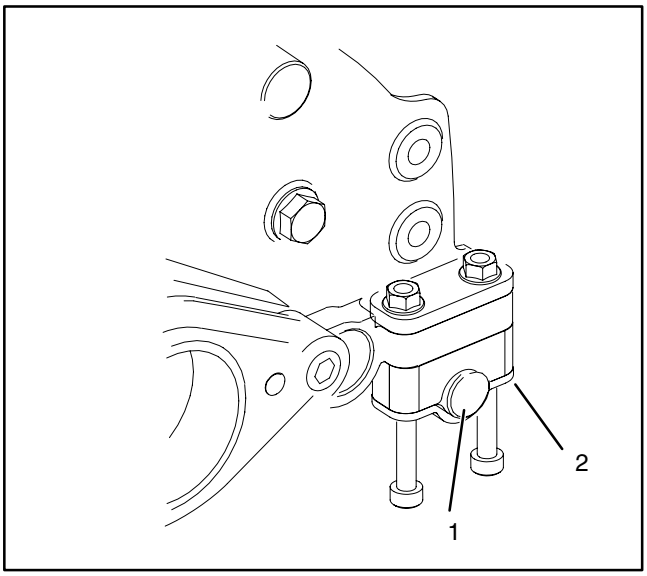

Figure 21

1. Rear roller **2. Saddle clamp**

10. Install the front roller (see Front Roller Installation in this chapter).

11. Adjust the cutting unit. See the Cutting Unit Operator's Manual for adjustment procedures.

Note: The parallel position of the rear roller to the reel is controlled by the precision machined components of the assembled cutting unit. Only a limited amount of adjustment is possible if necessary due to tapered reel wear. To adjust:

   A. Place the assembled cutting unit on a surface plate.

   B. Loosen each bedbar adjuster assembly, both cap screws (24), and all four shoulder bolts (7).

   C. Adjust the cutting unit and tighten the shoulder bolts (7) to a torque of **17 to 20 ft-lbs. (23 to 27 Nm).**

   D. Tighten the cap screws (24).

   E. Tighten each bedbar adjuster assembly until the adjuster spring is fully compressed, then loosen lock nut 1/2 turn.

Note: For severely tapered reels, a .010 in. (.254 mm) shim (Toro Part No. 106-6923) is available for the rear roller mount.

Preparing a Reel for Grinding

Note: Check to make sure the reel bearings are in good condition before grinding a reel.

1. Remove bedbar assembly (see Bedbar Removal and Installation).

2. Remove parts as necessary to mount cutting unit into grinder (e.g., front roller, front roller brackets).

Note: The cutting unit must be aligned so the grinding wheel will travel parallel to the reel shaft. This will result in the the reel being ground to the desired cylinder shape.

Note: When grinding, be careful to not overheat the reel blades. Remove small amounts of material with each pass of the grinder.

3. After completing the grinding process:

A. Install parts removed to mount cutting unit into grinder.

B. Install bedbar assembly (see Bedbar Removal and Installation).

C. Complete cutting unit set–up and adjustment sequence (see Cutting Unit Operator's Manual).

Reel Grinding Specifications	
Nominal Reel Diameter	5.06 in (128.5 mm)
Service Limit - Reel Diameter	**4.56 in (118.8 mm)**
Blade Relief Angle	30°
Relief Angle Range	20° to 40°
Blade Land Width	0.040 in (1.0 mm)
Land Width Range	0.030 to 0.060 in (0.7 to 1.5 mm)
Service Limit - Reel Taper	**0.040 in (1.0 mm)**

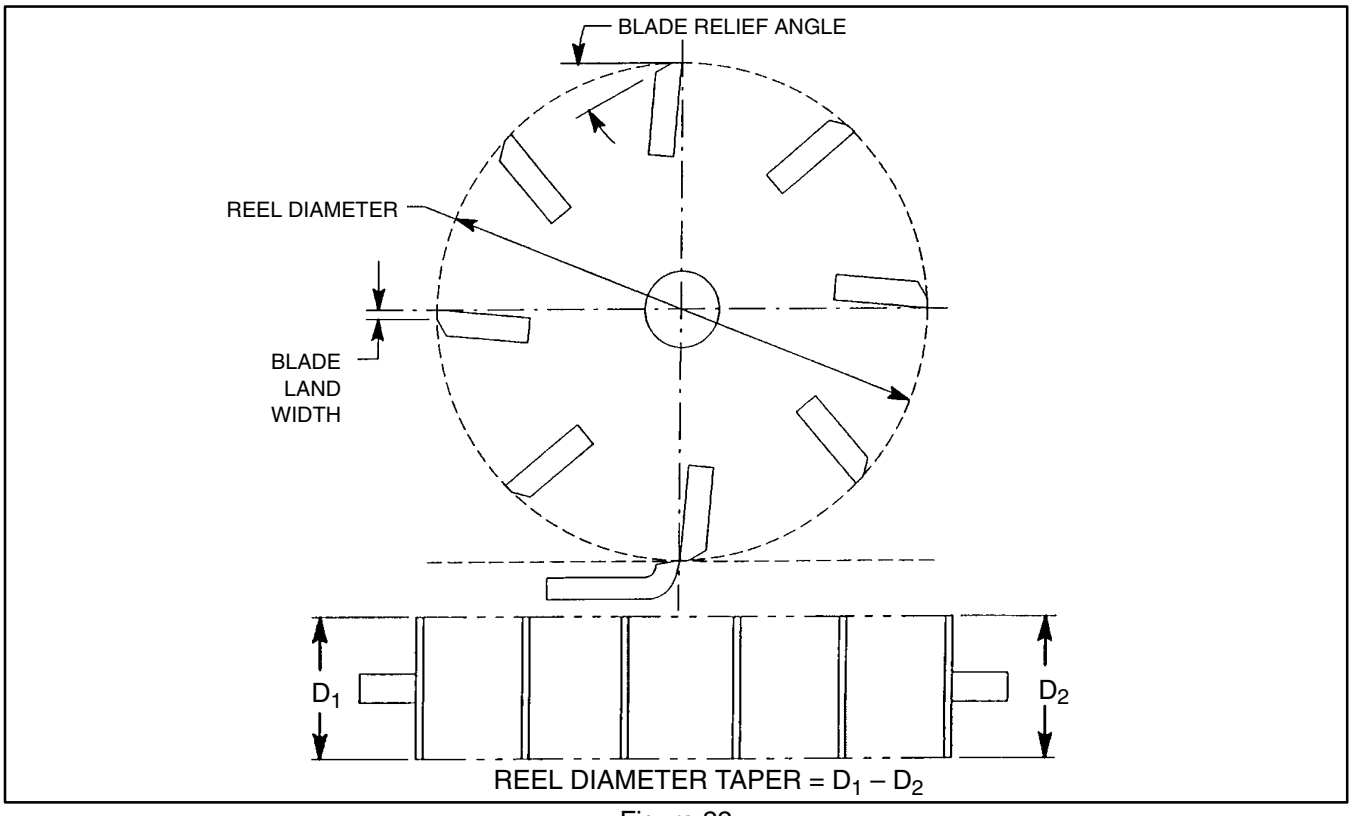

Figure 22

Front Roller Removal and Installation

Removal (Fig. 23)

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

Note: The front roller can be removed with the cutting unit either attached to the lift arm or removed from the lift arm. Determine your maintenance needs.

2. Loosen cap screws securing the roller shafts to each front bracket.

3. Remove the lock nut, tab washer, and carriage screw securing one of the front roller brackets to the cutting unit frame assembly.

4. Remove the front bracket and slide the roller and shaft from the cutting unit. Remove the remaining front roller bracket if necessary.

Installation (Fig. 23)

1. Place cutting unit on a level working surface.

2. If both front roller brackets were removed:

   A. Insert carriage screw through the cutting unit side plate and front bracket. Secure carriage screw and roller bracket with tab washer and lock nut.

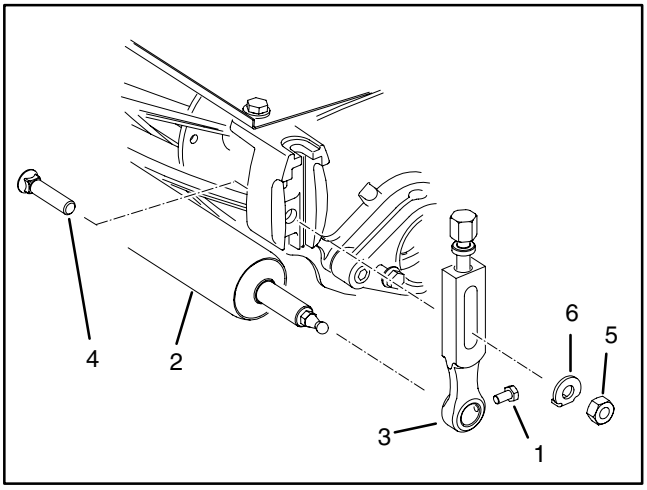

Figure 23

1. **Cap screw**
2. **Roller assembly**
3. **Front roller bracket**
4. **Carriage screw**
5. **Lock nut**
6. **Tab washer**

3. Slide roller shaft into the front bracket attached to the cutting unit. Slide second front bracket on the other end of roller. Secure bracket with carriage screw, tab washer, and lock nut.

4. Apply Loctite 242 or equivalent to the cap screw threads. Center roller in the front brackets and secure into place with the cap screws.

5. Adjust cutting unit height–of–cut (see Cutting Unit Operator's Manual).

Front and Rear Roller Service

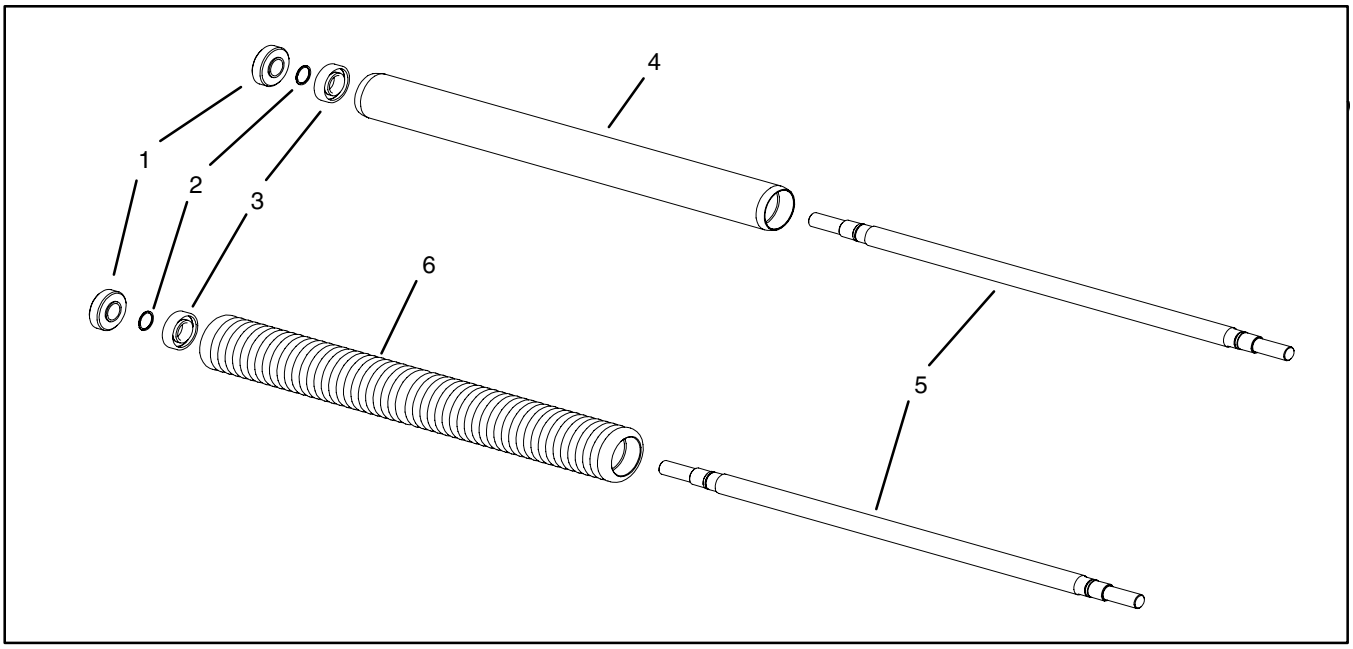

Figure 24

1. **Roller seal**
2. **Spiral retaining ring**
3. **Roller bearing**
4. **Rear roller body**
5. **Roller shaft**
6. **Front roller body**

Seal Removal

1. Make a seal removal tool from a 1/4 x3 x 3 in (.63 x 7.6 x 7.6 cm) piece of steel as shown (Fig. 25).

2. Slide seal removal over roller end of roller shaft.

3. Use the tool as a template to locate, mark, and drill two 7/64 in. diameter holes in the outer face of the seal.

4. Thread two No. 8 x 3/4 in long (.164 in. diameter) self-tapping screws through the seal removal tool and into the drilled holes in the seal.

5. Thread two 1/4–20 x 1 in. long cap screws into the seal removal tool.

6. Alternately tighten the cap screws to pull the seal from the roller body.

Note: Seals will be destroyed during removal. Do not re-use seals that have been removed from the roller.

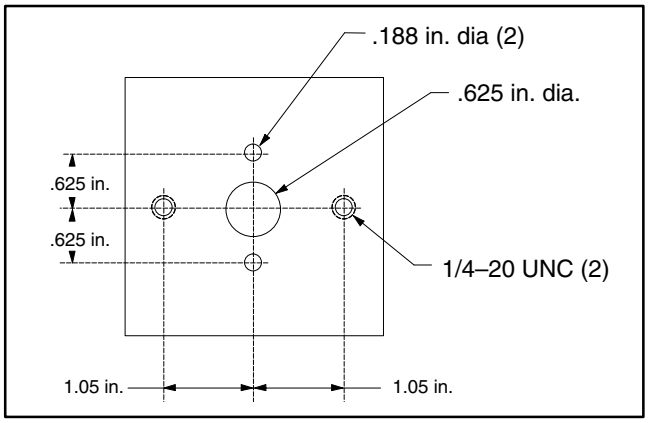

Figure 25

Seal Installation

1. Apply a thin film of clean oil to the inner lip of the seal and slide the seal over the end of the roller shaft.

2. Press the seal squarely into the roller body. The seal face should be flush with the end of the roller body when correctly installed.

Bearing Removal

Note: Replace both roller bearings as a set after a bearing failure.

1. Remove the roller seals (see Roller Seal Removal in this chapter of this manual).

2. Remove both spiral retaining rings from the roller shaft.

Note: Roller bearings have a press fit into the roller body and a slip fit on the roller shaft.

3. Loosely secure roller body in a vise. Lightly tap one end of the roller shaft with a plastic hammer to drive the shaft and one of the bearings from the roller body.

4. Use the roller shaft to remove the remaining bearing.

5. Clean roller bearing cavity and remove any rust or corrosion with an abrasive cloth.

6. Inspect bearings, roller shaft, spiral retaining rings, and roller body for wear or damage. Replace components as necessary.

Bearing Installation

1. Pressing against the outer race of the bearing only, drive one bearing all the way into either end of the roller body (Fig. 26).

2. Slide roller shaft through roller body and installed bearing.

3. Install spiral retaining ring against installed bearing.

4. Slide the remaining bearing onto the roller shaft. Pressing against the outer race of the bearing only, drive the remaining bearing all the way into the end of the roller body (Fig. 26).

5. Install remaining spiral retaining ring.

6. Install new seals (see Roller Seal Installation in this chapter of this manual).

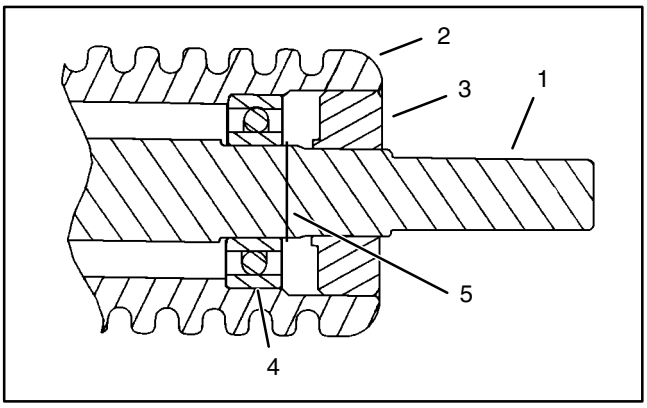

Figure 26

1. **Roller shaft**
2. **Roller body**
3. **Seal**
4. **Bearing**
5. **Spiral retaining ring**

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